Burning Gas and Coal Simultaneously in Boiler Furnaces—
Illuminating Office Spaces—and the Regular Departments

Electrical World

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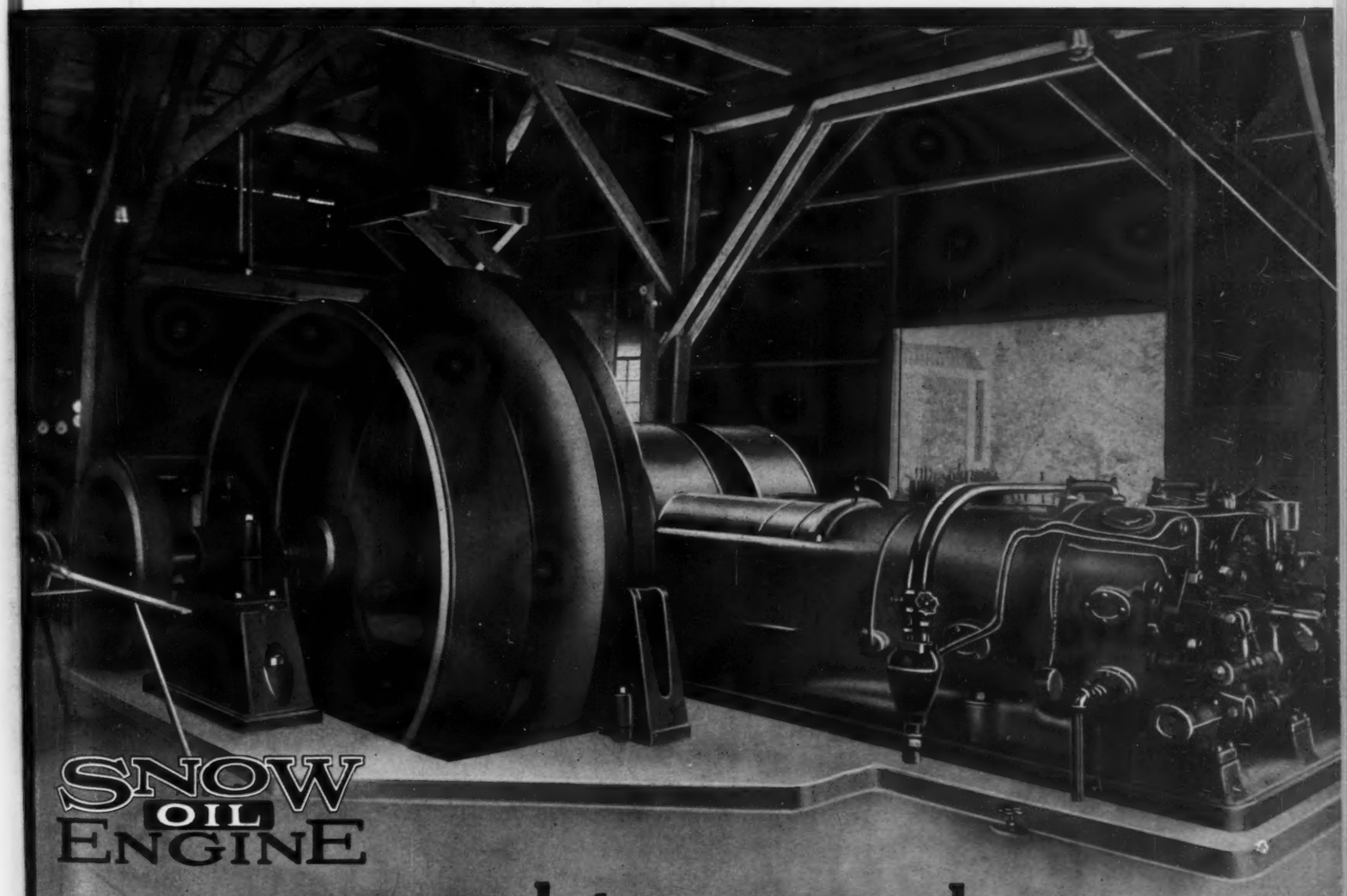

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Co-ordination in Power

CONSERVATION of invested capital receives new significance because of the necessary enormous outlay for war. Studied economy in the use of existing property and in additional investment is the demand of war. It does not meet the problem to cut off all expenditure ruthlessly; a higher, more effective quality of policy is needed. The question is: "How shall growing demand for energy be met by broad methods and far-reaching plans? How shall we assure the most efficient employment of every existing resource?" In California both State commission and private operators are co-operating in a plan for co-ordinating power facilities to give maximum service at minimum waste. The Massachusetts commission, deeply impressed by the same sound principle, authorizes transmission-line connection between the Fall River company and the New England Power Company. There is clear prophecy in its words: "High-tension transmission . . . has made possible and desirable that the developed sources of power, both steam and hydroelectric . . . shall be so co-ordinated by connecting lines as to result in utilizing all plants more uniformly and in the end in substantial economies in investment and operation." A local issue was involved, but the commission sees in it an opportunity to form precedents which are of highly important economic influence. Co-ordination of power-generating forces is true efficiency.

Determination of Alternator Regulation

THE problem of the determination of alternator regulation, at any assigned load and power factor, from data secured by preliminary tests, is a very difficult one, when a fairly high degree of precision is aimed at. The conditions are complicated. There is a certain amount of reactance in the armature windings, which depends to some extent upon the strength of the armature current. There is also a certain amount of armature reaction, which tends to affect the magnetomotive force developed by the field excitation. This varies with the phase and also to some extent with the strength of the armature current. Finally, there is also the resistance drop in the armature, which is ordinarily small by comparison with the effects just mentioned.

There are several methods of computation in regular use for arriving at the regulation, based upon characteristics of the alternator obtained from regular tests. One of the best is the Potier method, which takes each of the three component effects into separate account. The full development of the method leads to a somewhat lengthy formula. We print this week a graphical method, by A. S. Blatterman, which is swift in application, and which virtually follows the Potier method of computation with some simplification permitted in a graphical solution. The alternator is tested for short-circuit and open-circuit characteristics. From the known load and power factor, lines are drawn on the diagram of characteristics, whereby the excitation required may be immediately read off. The method has the limitations in precision to which all graphical processes are exposed, but the problem, at best, does not at present permit of a high degree of precision being reached.

Characteristics of Iron Wire for Transmission

WAR is a condition which necessarily interferes with normal conditions of supply in commodities. It is useless to cavil or repine at war prices. There would be no credit in being optimistic if the turning of a nation to warfare left all industry and prices in the ordinary status quo ante bellum. The demands for the electrically conducting metals tend to raise their prices to economically unattainable values. If copper and aluminum are not at present available for conductors, the question arises of what can be found during the interim to meet immediate needs in electric transmission.

In his article appearing in this week's Digest Prof. L. W. W. Morrow describes some comparative alternating-current tests of steel conductors arranged in pairs on a pole line. The losses in copper or in aluminum wires, if all the joints are good, depend only on the cross-section at a given temperature, and can be predicted with all desirable precision from the known resistivity of the material. In the case of iron or steel, however, the skin effect is very appreciable at ordinary frequencies, and depends to some extent upon the strength of alternating current carried. This is for the reason that the skin effect depends upon the permeability of the wire, as well as upon its size and conductivity, at the frequency employed. The permeability, in its turn, depends upon the magnetic force in and at the surface of the wire, which force is in proportion to the current carried.

The amount of power wasted in such steel wires, when carrying the strengths of alternating current ordinarily used in transmission, is very considerable. The only physical compensation lies in the greater tensile strength of steel in comparison with copper. This permits of placing the points of support further apart. In cases where steel conductors are decided upon there is a

strong temptation to take the benefit of this mechanical advantage. On the other hand, it would prevent the replacement of the steel by copper wires at more normal prices in years to come.

Magnetic-Mechanical Testing

UNDER existing conditions, iron and steel material which is chemically correct but deficient physically must be accepted for lack of a proper test which is applicable to the material as a whole. Mechanical testing, in tension, for example, hardness measurements, and microscopic examination, while of very great utility in many cases, frequently fail to define satisfactorily the state of a given material, even where it is commercially practicable to apply them in extenso. Every operation, whether thermal or mechanical, which induces a change in the working performance of a given iron or steel product appears to bring about a change in the magnetic characteristics, which is invariably repeated under similar circumstances. This is strikingly so when such operations produce changes in crystalline structure.

The presence of inhomogeneities or flaws, as in steel rails, for example—in which field considerable work has been done—results in changes in magnetic characteristics either because there is an actual reduction of the quantity of metal in certain portions of the section or because the physical properties are modified owing to strains or foreign inclusions. A future application of the homogeneity test which appears to be most promising is in the examination of the component parts of the large guns used in army and naval operations, as well as in car and locomotive axles, automobile axles, crank shafts, bridge members and aeroplane stay wires. In this latter connection it is important to point out that the local straining of steel wire beyond the elastic limit, in accidental bending, produces unfavorable changes in the mechanical properties which are accompanied by pronounced magnetic changes. Such magnetic changes are readily located. Excessive cold working of material, as well as the presence of gases, as in oxidized steel, effects changes of the magnetic characteristics, as has been pointed out by workers in these lines. Iron or steel which is to be enameled must be free from deleterious gases to be successfully coated.

One of the principal applications of magnetic-mechanical testing lies in the realm of steel, and especially high-speed steel, which is subjected to thermal treatment previous to use. It is essential here to know, before expensive processes are carried out, if the raw material is in a favorable condition, as the result of proper handling in the mill or forging plant, to respond to an established routine heat treatment. It is equally important to be able to determine, subsequent to heat treatment, if the definite thermal procedure has been faithfully carried out. Variations in thermal handling will unfailingly result in variations in magnetic characteristics. The Bureau of Standards has demonstrated the applicability and the precision of the Fahy permeameter for all such work.

Office Lighting

LIGHTING a space used for clerical work is one of the most troublesome problems with which the illuminating engineer comes in contact. We believe our readers will profit from Professor Clewell's discussion of the matter in our current issue. Office buildings involve some very curious differences of condition on account of the wide variety of work carried on, the great differences in the natural lighting attainable and the wide variations in height of rooms and interior finish. Again, the subdivision into various working spaces often involves serious difficulties even in large areas subdivided only by glass partitions and with ample window space. Good lighting looks easy, but is sometimes extremely difficult. On the other hand, one finds big office rooms in which there are no partitions properly so called, but which are cut up so badly by barricades of file cases and the like that ordinary arrangements of lighting are peculiarly inefficient. In no branch of illumination is the need of studying the detail of the actual arrangement of things greater. The typical small office in an office building is relatively easy. It is in the larger areas that such great diversity exists.

Professor Clewell points out in some detail the nature of the lighting systems used for these office spaces. We do not fully agree with him that semi-indirect lighting is inferior to straight indirect lighting for general office work. His contention, however, that many semi-indirect fixtures when used with gas-filled lamps present too great intrinsic brilliancy is absolutely sound, and in it we heartily concur. Certain types of so-called semi-indirect fixtures are on the market in which the intrinsic brilliancy of the glassware is pushed so high that from the standpoint of ocular hygiene the system is quite inadmissible. The trouble comes from a somewhat natural tendency to decrease the area of the diffusing surfaces in order to make a smaller fixture and save expense, using, for example, a 200-watt lamp in a fixture which really is suitable for nothing above 100 watts, and so on. In a few cases direct fixtures are entirely adequate and give admirable results. Such instances are those in which the diffusing glassware of the shade is big enough and deeply skirted enough to protect the eye fully from the light of the filament itself. With this provision met, direct units often serve well for providing a groundwork of general illumination in the instances where local conditions compel the somewhat free use of desk lamps.

In principle the illuminating engineer eschews desk lamps. A general illumination by one of the three common systems seems to be more logical and to give a far closer approximation to the fine diffusion of light one would naturally wish to see. Nevertheless it is a fact which is driven home to every man of large experience that there are many cases in which the conditions are best met by considerable use of desk lamps of a suitable character, for the simple reason that from those only can adequate light be given at certain points without an enormous waste of energy. Any one who has dealt extensively with those in charge of clerical rooms

realizes that as a rule they feel that the heavens had better fall at once and engulf the whole establishment than that any desk should be changed from the position that it now occupies. They say with some flavor of superciliousness that the illuminating engineer is supposed to be able to furnish general illumination for that room, and they do not see why they should shift the furniture to please him.

An analogous problem is the room used for bookkeeping, often a large, clear space with comparatively light finish, in which one would suppose that indirect or semi-indirect fixtures would do admirable work. So they would if it were not the habit in many establishments to have the clerks working over their finely ruled columns with a crow-quill pen dipped in ink which at the start flows sickly blue. Here again the desk lamp sometimes has to come into play. When used it should never be of high power, and it should always be thoroughly screened either by frosting the bulb in a diffusing reflector or by covering the mouth of the reflector itself with a diffusing medium. With either the semi-indirect or indirect systems very admirable results can be obtained where special problems do not confront one; but they turn up oftener than one would think, and it is not putting the case too strongly to say that the successful lighting of an office space requires more patient and careful study of local conditions than almost any other branch of the art.

Combining Gas and Coal

THOSE of our readers who deal with steam plants will find profitable food for thought in Alex W. Morgan's paper descriptive of recent experiments in firing boilers with a combination of coal and fuel gas. The work was done in the plant of the Toledo Railways & Light Company, and its immediate cause was the necessity of greater boiler output at once to meet the growing demands for energy. In this case the gas was not used as a substitute for coal except at certain times, but employed to force the output of the boilers by actually adding the gas combustion to that of the coal in the furnace. A cheap supply of good fuel gas was available from a large by-product coke oven.

Somewhat extensive experiments were made to find the best way of utilizing the new fuel, resulting in the combination burning which Mr. Morgan describes. In the earlier work gas alone was burned under the boilers with only moderate changes in the furnace arrangement other than the addition of broken firebrick over the grate. It was found that the arrangement worked well but would not permit the boilers to be forced as much as was desirable. A Dutch oven was then tried on a boiler, and it increased the rating considerably, without, however, reaching the results which were thought desirable. Finally a boiler was equipped as described in Mr. Morgan's paper with gas burners shooting the gas directly down upon the burning coal, itself fed forward by a chain grate. This made it possible to push the boiler output more than 30 per cent above the figure attainable by coal alone, and with a good degree of economy. The flue gas was slightly hotter than with coal alone; the unburned residuum in the ash was slightly greater, both results being probably due to a somewhat inadequate supply of air for the needs of the combined fuel; for all the air supplied was that passing up through the fire. The efficiency of the boiler and furnace using the combination was only a shade higher than with coal alone. All this probably merely shows that there was a slight loss of relative efficiency in forcing the output to the extent desired. With gas alone, at such output as was feasible with gas, the efficiency was better than with either coal or the combination.

Of course, the actual economics of the situation were controlled by the relative cost of gas and coal, but since the price of the latter is very much on the up grade it seems reasonably certain that in many instances it would prove more economical to use gas or gas and coal together than the latter exclusively. The particular point in the paper is, however, the great benefit of the expedient of pushing the output of boilers already installed to the point demanded by a growing peak load. In these days of extraordinary industrial growth central stations are likely to have large calls for increased output. Deliveries on boilers are slow, and if a supply of cheap gas is available, its addition to the coal fires already burning gives added output enough to tide over many a serious emergency. The regions in which the device can be successfully used are, of course, comparatively limited, but they are mostly regions in which manufacturing plants are daily springing up and requiring power.

The Coming Issues

THE time is not far distant when the type of high-tension apparatus requiring protection against the weather will have disappeared entirely. Meanwhile existing arrangements in outdoor stations should be improved and equipment should be modified so that the expense of constructing, operating and maintaining stations in serviceable condition will be minimized. Particular attention should be given to avoiding awkward wiring, providing for extensions and eliminating operating hazards. In the next issue of the ELECTRICAL WORLD an article will be presented in which these points as well as others will be discussed. The eighth installment of Professor Clewell's series on lighting will also appear, the subject being lighting in iron and steel mills. Among other things, attention will be called to methods of overcoming such obstacles to effective illumination as high roofs and dust-pervaded atmosphere. In the fourth issue of July there will be discussed in a symposium the advisability of furnishing sales and other employees with appliances free of cost. It has been generally felt that those selling appliances should be familiar with their working through a personal knowledge gained from experience. Reports which have been received from a number of companies show very definite tendencies.

Combination Coal and Gas Firing

Methods Used to Burn Coal and Coke-Oven Gas Simultaneously Under Same Boilers—Results of Tests to Determine Efficiency and Adaptability of Confined Fuel

BY ALEX W. MORGAN

BECAUSE the addition of more boilers in its Water Street station was inadvisable with a new station on another site in prospect, and because the increasing load demanded immediate additional plant output, the Toledo Railways & Light Company equipped some of the boilers already in its Water Street station with apparatus for burning coal and coke-oven gas at the same time. By this expedient it was possible with the existing equipment to increase the boiler output economically and thus to care for the growing load. Particular interest attaches itself to the results of this venture, because of the present high price of coal and because of the applicability of the plan to other plants which have producer gas or other suitable gas available.

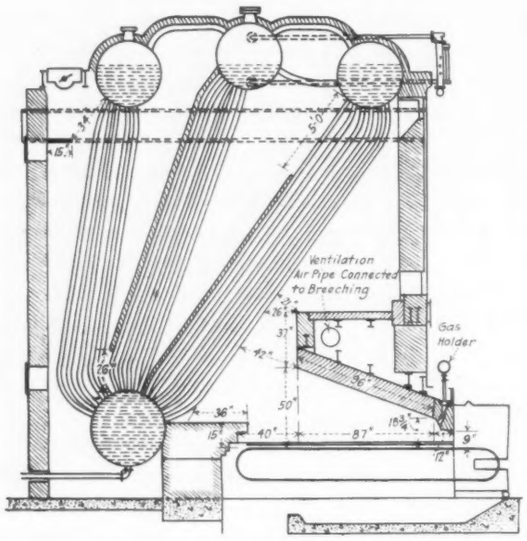


FIG. 1—THE TYPE OF ARCH AND BAFFLE CONSTRUCTION MADE USE OF IN TEST BOILER

CONDITIONS INFLUENCING OPERATION

The conditions which made this solution of the problem possible were as follows: The Toledo Furnace Company installed a by-product coke oven and contracted to sell the entire gas output to the Atlas Chemical Company. The latter concern under its contract is receiving about 9,000,000 cu. ft. (247,208 cu. m.) of rich gas each twenty-four hours in excess of its needs. The chemical company needs only the lean gas for its operations. Therefore the rich gas, which has an average heating value of about 600 B.t.u. per cubic foot (21,429 B.t.u. per cu. m.) and which is the "first-run gas" from the ovens, is being delivered to the Toledo Railways & Light Company through a 20-in. (50.8-cm.) main which was approximately 4 miles (6.4 km.) long.

Experiments were tried with several different methods of combining gas and coal firing, but it is now thought that burning coal and gas at the same time in the same furnace proves most economical. The company has therefore equipped a large number of its boilers for the combination operation.

ARRANGEMENTS FOR BURNING GAS ALONE

At first gas alone was burned under six type S 475-hp. Stirling boilers equipped with McKinzie grates, which, owing to limited area, could not be operated much above rating. In these furnaces the grates were partly covered with asbestos. A space 12 in. (30.4 cm.) wide was left uncovered for a secondary air port. The front of this air port was 40 in. (101.6 cm.) from the burner tips and flush with the nose block of the ignition arch. Over the entire grate surface was spread firebrick crushed to the size of an egg, the layer varying in thickness from about 2½ in. (6.4 cm.) at the burner tips to 7 in. (17.8 cm.) at the bridge wall. This covering deflected the flame and prevented it from striking the tubes directly.

The burner consisted of a 6-in. (15.2-cm.) air mixer, 14 in. (35.4 cm.) long, swedged down to 5 in. (12.7 cm.) at the outlet. This arrangement was successful for operating up to 175 per cent of rating, but would not do for higher boiler output. It was not so flexible as was desired. To increase the overload that might be carried the grates were removed and one boiler was equipped with a Dutch oven. It was possible to get 263 per cent rating from this unit. The installation, however, was inflexible.

To burn the gas directly above the coal and in combination with it, a special tile with a 2.5-in. (6.4-cm.) hole was developed and set so that the gas when introduced into the firebox was directed down against the coal. This tile was placed in the ignition arch next to the grate. All primary air was shut off and the gas in the firebox had to depend upon secondary air coming through the fuel bed for its combustion.

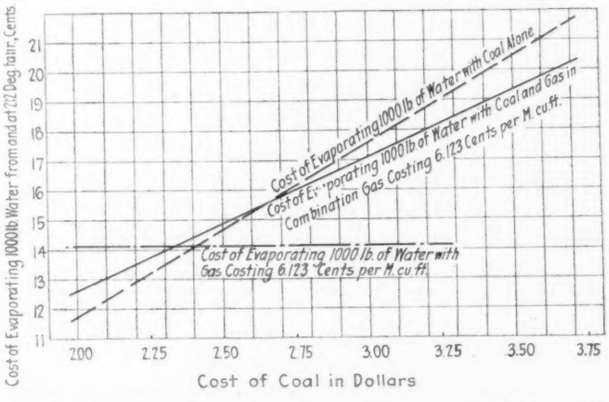
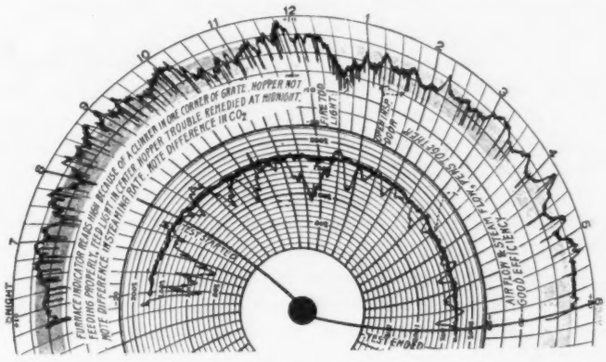
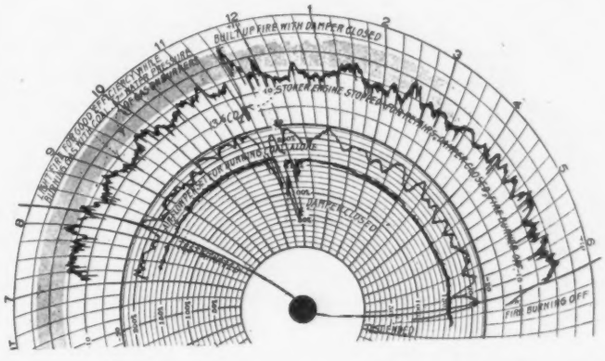


FIG. 2—CURVES SHOWING POINTS AT WHICH COMBINATION COAL AND GAS FIRING IS ECONOMICAL

After these preliminary experiments had been carried out arrangements were made for conducting tests to determine accurately the performance of the newly

equipped boilers. The boiler used for these tests is of the Stirling type. It has a heating surface of 6680 sq. ft. (620.6 sq. m.), a superheating surface of 256 sq. ft. (23.8 sq. m.), and is designed to deliver steam at 200 lb. per square inch (14.06 kg. per sq. cm.) pressure and 100 deg. Fahr. (37.8 deg. C.) superheat at rating. It is equipped with a Bailey boiler meter and a Greene type K chain-grate stoker, 10 ft. (3.05 m.) wide and 11 ft. 7 in. (3.53 m.) long, giving 115.85 sq. ft. (10.8 sq. m.) of firing surface. The ratio of air space through the chain to the solid portion is approximately 21.5 per cent. The speed of the chain can be varied from 4 in. to 9 in. (10.2 cm. to 22.9 cm.) per minute under normal operation. A flat-inclined ventilated arch


FURNACE INDICATOR READINGS BECAUSE OF A CLINKER IN ONE CORNER OF GRATE; HOPPER NOT FEEDING PROPERLY; FED LIGHT IN CENTER HOPPER TROUBLE REMEDIED AT MIDNIGHT.
NOTE DIFFERENCE IN MASTER RATE
NOTE DIFFERENCE IN CO2
MIDNIGHT



FIGS. 3 AND 4—BOILER METER RECORDS OF TEST WHERE COAL ALONE WAS BURNED AND WHERE GAS AND COAL WERE FIRED IN COMBINATION

ascertain what advantage, from an increased rating and economy standpoint, the combination of burning coke-oven gas above coal has over burning straight coal or straight gas in a furnace primarily constructed for burning coal. Five tests were run as follows: First, coal alone operating the boiler for maximum rating; second, coal and gas together operating the boiler for maximum rating; third, coal alone as a check on test No. 1; fourth, coal and gas in combination as a check on test No. 2; fifth, gas alone operating the boiler for maximum rating as used on night load. The results of these tests, together with the heat balance, are given herewith.

An analysis of the results obtained shows that the amount of coal burned per hour with the combination firing was practically the same as the amount burned when coal alone was fired. Therefore the additional rating developed was the result of the introduction of gas in the furnace. The rating developed by the gas and coal in combination was 337 boiler-hp., or an additional rating of 31 per cent over that obtained with coal alone.

The temperature of flue gas leaving the boiler was 43.4 deg. Fahr. (6.3 deg. C.) higher with the combination than with coal alone. The stack temperature was considered to be too high on all tests, and it is thought that it could be reduced by changing the baffling from a three-pass to a four-pass arrangement. It was found that better results came from getting a lower stack temperature with the combination than from coal alone. The consequent reduction in draft in the uptake amounted to 10.9 per cent and over the fuel bed to 20.7 per cent.

Not much better efficiency of the boiler, furnace and grate was obtained with the combination fuel than with coal alone. The efficiency with gas alone was 11.35 per cent higher than with either the combination fuel or coal alone. The efficiency of the boiler and the furnace with the combination fuel was 2.8 per cent higher than with coal alone, and the efficiency with gas alone was 6.85 per cent higher than with coal alone.

The amount of combustible by weight in the ash was greater with the combination than with coal alone. The increase in this combustible amounted to 2.9 per cent of the total coal supplied to the furnace. Expressed in per cent of increase of combustible in the ash, this amounts to an increase of 33 per cent. The speed of the chain grate was only increased 4.52 per cent, so that the increase in combustible must be charged

is used in a form slightly modified so as to be practical for combination firing. The gas burner, which consists of a 1.5-in. (3.8-cm.) pipe with a cap drilled with seven 7/16-in. (11.1-mm.) holes, is inserted in the top of a channel in the special tile. No particular overhauling was given the boiler, grate or setting prior to the test. Taken as a whole, the unit was said to be in average operating condition.

COMPARISON OF BOILER PERFORMANCE BURNING COAL AND GAS SEPARATELY AND COMBINED

	Coal* Alone	Coal and Gas*	Gas** Alone
Pounds of coal used per hour	4,374	4,426.3	.....
Pounds of equivalent coal used per hour	.....	1,278.5	2,006
Equivalent pounds coal burned per square foot of grate surface	37.8	49.4	17.45
Cubic feet of gas burned per hour	.....	29,163.0	47,785.00
Cubic feet of gas burned per pound of dry coal	.....	6.61	.....
Per cent of ash and refuse to total coal	18.89	21.43	.....
Per cent of rating developed	162.25	213.	88.7
Temperature of flue gases leaving boiler (in deg. Fahr.)	640.1	683.5	516.6
Draft over fire	0.363	0.2875	0.0316
Draft in uptake under damper	0.920	0.820	0.0573
Efficiency of boiler grate and furnace in per cent	61.4	61.6	72.95
Efficiency of boiler and furnace in per cent	66.1	68.9	72.95
Pounds of combustible in ash	385.7	517.9	.....
Per cent combustible in ash to total coal burned by weight	8.8	11.7	.....
Speed of chain in inches per minute	6.64	6.94	.....
Cost to produce 1000 lb. of steam from and at 212 deg. Fahr. (in cents)	11.65	12.58	14.10
HEAT BALANCE—Per Cent:			
CO_2 in flue gas	10.43	12.37	6.75
O in flue gas	10.50	4.85	7.85
N in flue gas	79.07	82.78	85.40
Over ventilation	102.0	29.1	53.5
Heat absorbed by boiler	61.38	61.62	72.95
Loss by moisture in coal	0.34	0.30	.....
Loss by burning hydrogen in coal and gas	4.13	6.16	12.58
Heat lost by dry chimney gases	16.87	13.72	9.59
Heat lost by unconsumed carbon in ash	9.50	9.76	.....
Heat lost by apron water	0.72	0.59	0.15
Heat unaccounted and unaccounted-for losses	7.06	7.85	4.73

*Average of two tests. **Average of one test.

The object of the series of tests conducted was to

against inability to burn owing to the introduction of the gas above the coal. However, taking into account the heat supplied by the gas as well as that supplied by the coal, the percentage of total heat lost by unconsumed carbon in the ash was practically the same for the combination as for coal alone, amounting to 9.76 per cent for the former and 9.50 per cent for the latter.

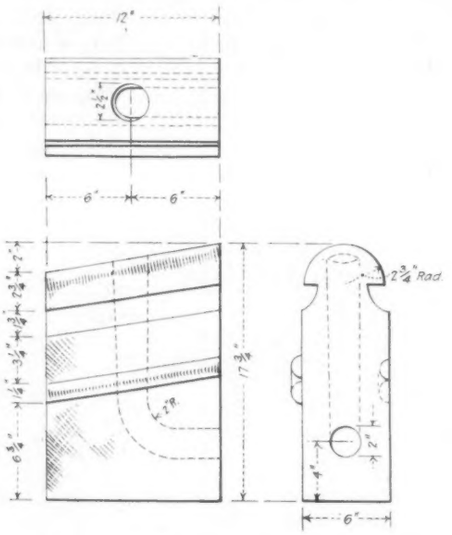


FIG. 5—SPECIAL GAS NOZZLE TILE USED TO CONDUCT GAS INTO FIRE BOX OVER COAL

It was considered that this loss was too high, and steps were taken to effect a reduction in it.

Owing to the low ultimate CO_2 (10.8 per cent) obtained by complete combustion of coke-oven gas, the ultimate CO_2 for combination of coal and gas will be lower than the ultimate for coal (20.9 per cent). When 6.11 cu. ft. (0.172 cu. m.) of gas is burned in addition to each pound (0.45 kg.) of coal, the ultimate is 16.9 per cent, while 7.11 cu. ft. to each pound (0.046 cu. m. per kg.) of coal is 15.4 per cent.

CONCLUSIONS ARRIVED AT

From the foregoing results it was concluded that the cost of evaporating 1000 lb. (45.4 kg.) of water from and at 212 deg. Fahr. (100 deg. C.) is 8 per cent higher for the combination fuel than for coal alone, and 21 per cent higher for gas alone than with coal alone. These figures were, of course, based on the cost of fuel as it was at the time of the tests; that is, November, 1916. Nevertheless, it was calculated that the added capacity with the combination fuel was obtained at 50 per cent less investment than would have been required with the coal.

Viewed from an operating standpoint, it will be observed that the company obtained 31 per cent added capacity with an 8 per cent increase in the cost of producing a pound (0.45 kg.) of steam. With the increased cost of coal becoming operative, this increase in cost over the cost of coal to produce a pound (0.45 kg.) of steam would be offset (Fig. 2). With these facts taken into consideration, it was believed that this method of obtaining increased rating is ideal where coke-oven gas or other gas is available at a reasonable price, and where a plant needs more boiler capacity and yet has not enough room to permit of the installation of additional boilers.

METHODS OF MAKING TEMPORARY MOTOR REPAIRS

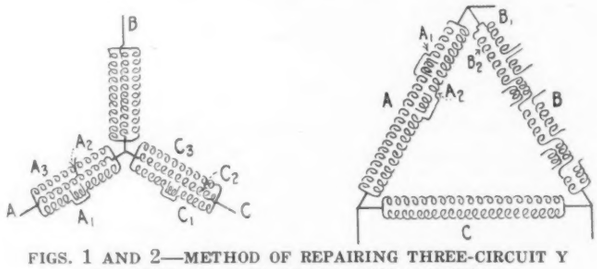
How Motors with Burnt-Out Coils Can Be Made to Give Temporary Service and Thus Prevent Large Loss in Production

BY H. L. HAYES

While most large industrial plants carry spare motors for use in place of those that are burned out, many small plants do not always have spare units on hand, and even when they have it frequently takes a long time to install them. Since only a few coils rather than the entire motor usually burn out when a motor "breaks down," the machine can be kept running in many cases until it is convenient to make permanent repairs by cutting out the defective coils.

With small-size, low-voltage motors, which usually have single or two-circuit Y or delta windings, this does not involve much difficulty. Unbalanced current may be drawn from the line when coils are cut out, but as a rule this will not seriously affect the power system. It is simply a case of whether the motor can carry its load and whether the winding can stand the increased current. If the motor is not too heavily loaded, it is possible to cut out quite a large number of coils and still operate the motor. If a motor has a large number of coils, with only a few turns per coil, several coils per phase can be cut out, but in motors having comparatively few coils, with a large number of turns per coil, this cannot always be done.

Complications may arise when attempting to apply this emergency repair scheme to large motors which usually have multiple-circuit windings because cutting out a coil causes local currents. In such a case if coils are cut out of one circuit it is sometimes necessary to cut out coils in all circuits which are in parallel with this particular phase. While this change may leave the phases unbalanced with relation to each other, the individual circuits of the phases will be equal. For instance, consider Fig. 1, in which is shown a three-circuit Y winding with coils cut out of A-1 and C-1 circuits in phases A and C. In a winding like this, circuit A-1 and C-1 may be completely cut out, leaving only two circuits for these two phases, but this would reduce the capacity of the motor a great deal. If, however, an equal number of coils were cut out of the parallel circuits, the motor may carry practically its entire rated load.

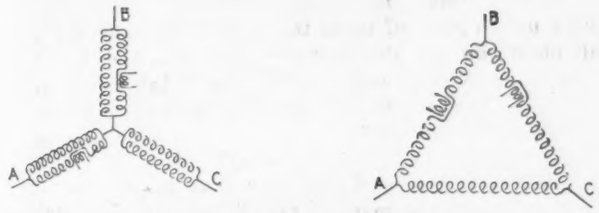


FIGS. 1 AND 2—METHOD OF REPAIRING THREE-CIRCUIT Y WINDING AND TWO-CIRCUIT DELTA WINDING

The changing of the arrangement of connections, such as converting a two-circuit Y connection into a single-current delta type, may also often permit emergency operation. The different schemes outlined reduce the capacity of the motor, but if it is carrying a variable load, which is often the case, continued operation may

be maintained because even though the winding will heat up on the peaks, it can cool down during the light-load periods.

Different applications of these principles have been made in a New England paper mill, where 25-cycle, 440-volt, three-phase motors are used and shutdown of one motor often means a large loss of production. Prior to cutting out coils or changing connections, tests



FIGS. 3 AND 4—BURNT-OUT DOUBLE-CIRCUIT Y WINDING RECONNECTED INTO SINGLE-CIRCUIT DELTA WINDING

are made to detect open circuits, grounds or short-circuits between phases. This is done with an ordinary lamp extension having one wire open-circuited and connected with a 110-volt circuit. Although 110 volts can be used to indicate dead grounds or short circuits, and is relatively easy to handle, it is better to use the full motor voltage with a bank of lamps in series to make the final tests, because it frequently happens that 110 volts will not detect partial defects that the higher voltage will bring out.

With a motor having a single-circuit winding it is a simple process to disconnect the separate phases, but with multiple connections this is liable to involve considerable work. It is therefore much quicker to try operating the motor before disconnecting any leads, noting as nearly as possible where it flashes. The particular section which appears defective may then be disconnected and tested for faulty coils. The objection to this method is that more coils are liable to be damaged with every flash, but if time available for repair is limited such procedure permits a saving of several hours. Furthermore, small fuses can be connected into the circuit for the purpose of limiting the short-circuit current.

Following are a few examples of how motors have been kept running which would ordinarily have had to

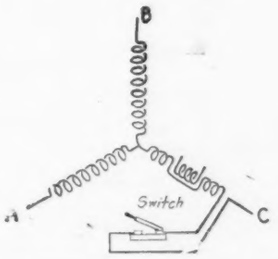


FIG. 5—DAMAGED Y WINDING CONNECTED FOR THREE-PHASE STARTING BUT SINGLE-PHASE OPERATION

be taken out of service for rewinding. A 50-hp. motor having a two-circuit delta winding broke down, spoiling a number of coils. On examination it was found, as shown in Fig. 2, that no coils in phase C were damaged. However, circuit B-1 of phase B was badly burned, so that it could not be left in circuit. A few of its undamaged coils were connected with parts of circuit B-2 to take the place of coils burned out in the latter, thus making nearly a complete single circuit for this phase. As several coils in the A-2 circuit and only one coil in A-1 circuit were damaged, enough coils were cut out of A-1 to even it up with A-2. This motor would not have carried a heavy continuous load, but it was used for over two months during the cold weather to run a circular saw.

Another 50-hp. motor having a two-circuit winding broke down, injuring only two coils. With only these two coils cut out the winding heated up in a few minutes, though running light. The coils in this motor had an exceptionally large number of turns per coil and comparatively few coils per phase. Instead of trying this motor with coils cut out of other circuits, it was changed into a single-circuit delta winding. Thus changed, the motor was incapable of developing its rated power, but it did not have to carry a continuous load. The original and final connections with coils cut out are shown in Figs. 3 and 4.

In another case a motor with single-circuit Y windings, running a small pump, broke down, injuring one coil in one leg and several coils in another. Cutting out the injured coils permitted more than full-load current in one phase even with the motor running light. Ordinarily a small motor can easily be replaced, but there was no spare motor available at this time. Since this motor could handle the load when it was running single-phase, a switch was connected in series with the weak phase to permit starting three-phase. After the motor was up to speed, the switch was opened and the motor left running single-phase. The final connections are shown in Fig. 5.

Rotors cause comparatively little trouble, but one case occurred at this paper mill where a coil-wound rotor rubbed on the stator and injured a number of coils. The bars which formed the coils in this winding had been bent after they were put into the slots, so it was impracticable to take them out for retaping. Since no new bars were available, the bad bars were disconnected and replaced by ordinary wire cables passed through the arms of the spider instead of through the slots.

The cases mentioned illustrate that a motor is not necessarily "down and out" because it "shoots fire." While it is surprising how badly a motor may be damaged and yet be capable of carrying its load, it is not advisable to run motors in such condition any longer than necessary, as there is a loss of efficiency in both motor and line.

Progress of Electric Taxicabs in St. Louis and Elsewhere

The most recent installation of electric taxicabs, which are successful in Detroit, is in St. Louis, where six cars make up the nucleus of a fleet. The Electric Vehicle Section, N. E. L. A., is advised that an electric taxicab company is now being organized in Mexico City. Aside from the generally appreciated virtues of the electric taxicab, it is cosmopolitan, for it is also found in successful operation in Shanghai, China. Progress is being made in the matter of the initial fleet of about 500 electric taxicabs of the most advanced type, which it is intended to put into operation in New York City in the near future.

Illumination of Business Office Spaces

Lighting Requirements and Relative Advantages of Direct, Indirect and Semi-Indirect Lighting—Some Typical Examples of Different Kinds of Equipment in Old and New Buildings

BY C. E. CLEWELL

Assistant Professor of Electrical Engineering, University of Pennsylvania.

SUMMARY.—This article reviews modern methods of illuminating offices, board rooms, and other spaces in office buildings. Emphasis is placed upon the illuminating qualities which are essential for the exacting work of such rooms, chief of which are quantity, distribution and freedom from glare. An example of a change-over from very inferior lighting to a much improved condition without change in the position of outlets is explained as typical of improvements which may be made in many older office buildings where antiquated fixtures and methods are still in use. The three present accepted schemes of direct, semi-indirect and indirect illumination are contrasted and outlined on a basis of actual installations. The effect of the lighting conditions on the occupants of offices is very important as the salaries in such buildings often amount to very large values per unit of floor area. Several special problems in the lighting of office equipment, such as filing racks and adding machines, are illustrated.

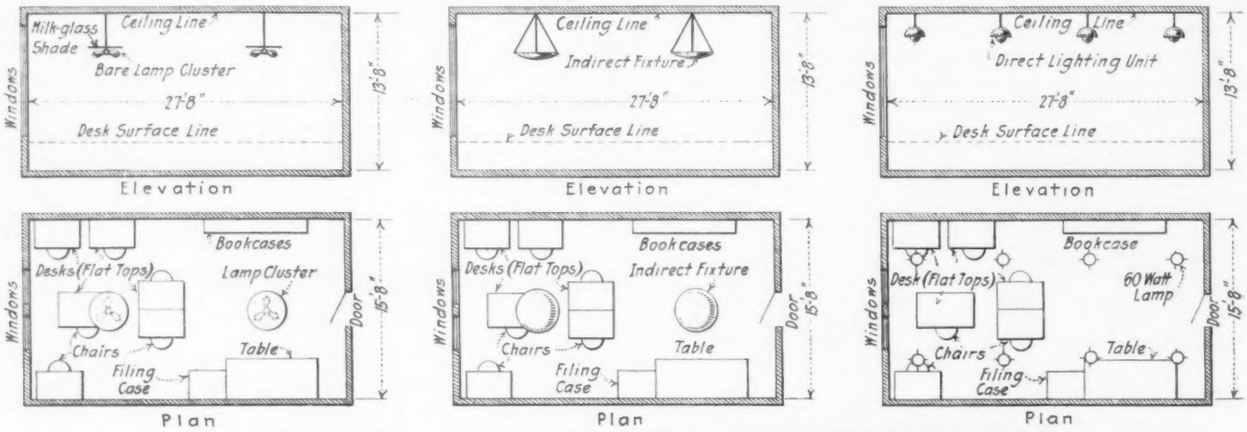
IN OFFICE buildings constructed ten or more years ago it is not uncommon to find antiquated lighting fixtures still in use which are not only totally inadequate for the needs of the work but for which there is no longer any excuse with the vastly improved methods of illumination now available. A good example of a recent change-over from such an old scheme is shown by Figs. 1 and 2. The lateral windows at one end of the office give a poor distribution of daylight during a large part of the day. Each of the old fixtures was originally equipped with three carbon-filament lamps. Later tungsten lamps were substituted. Since the entire lamps were visible from the floor the substitution of tungsten lamps greatly increased the glare.

In studying this office preparatory to changing the lighting system it was apparent that work was almost impossible on desks facing the wall on very dark days because of the poor distribution of the illumination and also owing to the shadows cast on the papers by persons sitting at the desks. To rearrange the outlets was difficult on account of the type of filled-in ceiling construction, so indirect fixtures were substituted for the old direct-lighting units and served from the original ceiling outlets. With these it is possible to work comfortably at the wall desks even on dark days and at night, the effect, however, being somewhat better at night than on dark days.

This example may be taken as typical of many cases in older buildings, and it shows that great improvements may often be made in the illumination by a careful selection of modern fixtures even with a poor arrangement of outlets as far as a direct-lighting system is concerned. With new buildings, where the outlets may be installed according to present ideas, direct lighting might be used in an office like that shown in Fig. 1 by arranging the outlets as shown in Fig. 3. Either of the schemes shown by Figs. 2 and 3 is vastly superior to that indicated by Fig. 1.

RELATIVE MERITS OF DIRECT, SEMI-INDIRECT AND INDIRECT SYSTEMS

A great deal of discussion has taken place on the relative merits of the three principal methods now used for the illumination of offices—that is to say, the direct, the semi-indirect and the indirect methods. In some cases the occupants of offices have been questioned extensively in an attempt to determine on a basis of the eye which method is fundamentally to be preferred. From the basis solely of effective lumens per watt on the desk surfaces the direct system is, of course, superior, but the exacting nature of much office work and the tax it places on eyesight make the factors of eye fatigue and eye comfort much more important than the mere efficiency of the lighting.



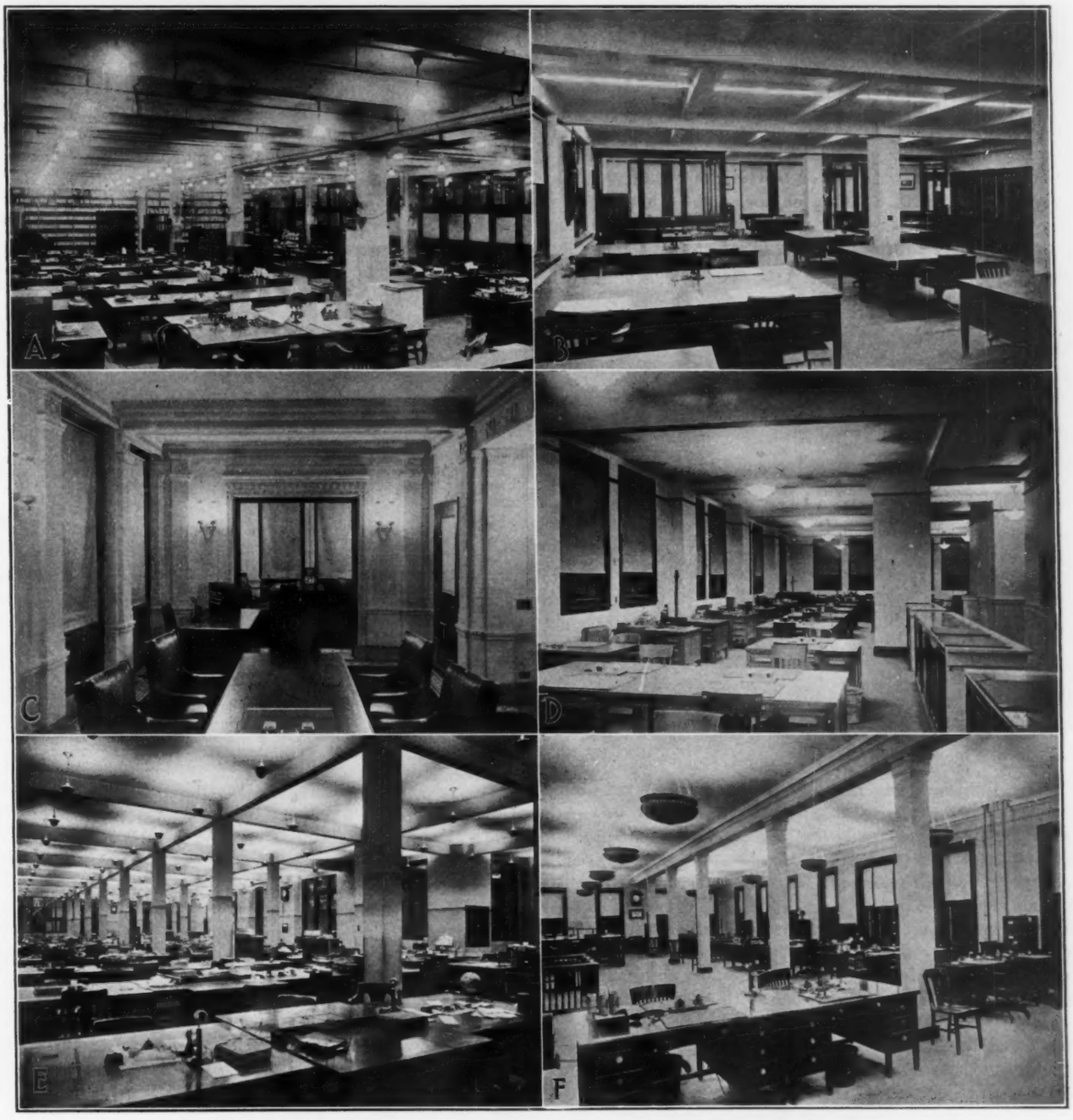
FIGS. 1, 2 AND 3—OLD METHOD OF LIGHTING OFFICES AND TWO IMPROVEMENTS THEREON

Extended observation in actual cases leads to the conclusion that with the greatly increased concentration of light in very small lamp filaments there is little room for controversy in the choice of a system. With direct lighting the difficulty of completely inclosing the filament of tungsten lamps, coupled with the general inadequacy of inclosing glassware in keeping the intrinsic brilliancy of its surfaces down to a reasonable value,

makes this system at the present time undesirable for many office spaces.

For similar reasons the glassware of many semi-indirect fixtures, particularly when used with nitrogen-filled lamps, is usually so bright that the glare in offices of ordinary height is both objectionable and harmful. Therefore lighting from concealed sources has a number of superior features over either of the other two methods just referred to.

By virtually eliminating shadows, however, the indirect method gives a certain flatness to the illumination of large office spaces. The almost perfect uniformity of the illumination tends to tire the eye because of the absence of relatively dark spaces which may be used for relaxing the eye now and then. Where artificial light is required only at dark portions of the day, and perhaps very occasionally at night, the contrasts during day periods are rather more marked than at night, when the indirect units furnish the entire illumination. It is believed, therefore, on the average, that the in-



FIGS. 4, 5, 6, 7, 8 AND 9—DIFFERENT METHODS OF ILLUMINATING OFFICE SPACES

A—Direct-lighting system employing 100-watt gas-filled tungsten lamps with intensive satin-finish reflectors placed 11 ft. above floor and producing 10 ft.-candles intensity on desk surfaces with power demand of 1.4 watts per square foot. B—Direct lighting employing linolite system. C—Wall brackets equipped with linolite fixtures. D—Semi-indirect system employing 400-watt gas-filled tungsten lamps and semi-indirect fixtures 12 ft. above floor and producing average intensity of 6.2 ft.-candles with a power consumption of 1.5 watts per square foot. E—Indirect system employing single-unit 100-watt vacuum-type tungsten lamps. Each bay has an area of 320 sq. ft.; the ceiling height is 15 ft. 9 in.; the distance between the top of the bowl and the ceiling is 30 in. Each bay contains four units giving a power demand of 1.25 watts per square foot. F—Indirect system employing multiple-unit fixtures containing three 100-watt vacuum-type tungsten lamps per fixture. The bays measure 13 ft. 3 in. by 16 ft., and the ceilings are 13 ft. high. The distance between the top of the bowl and the ceiling is 36 in.

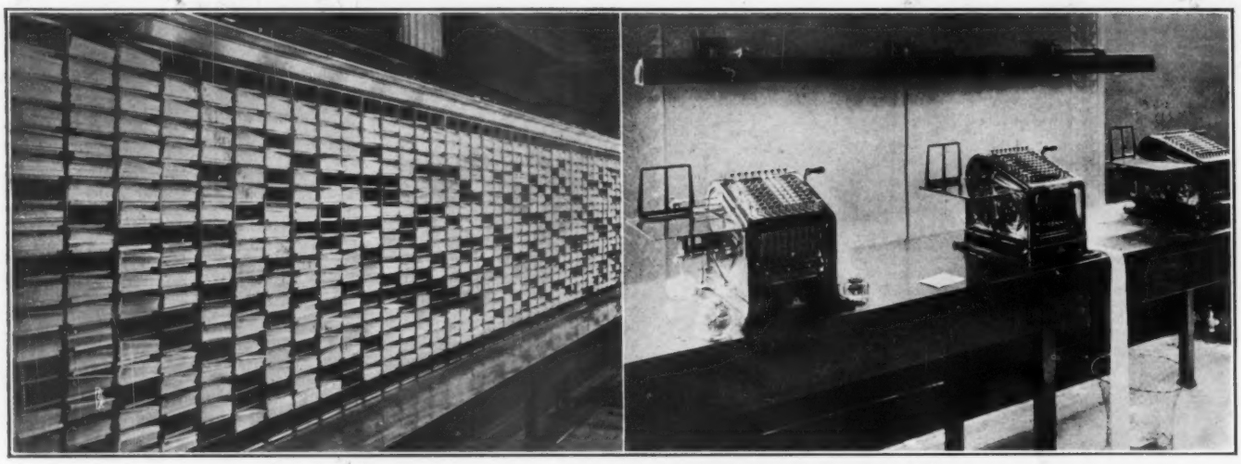
direct scheme of lighting, if properly installed, is by far superior to much of the direct or semi-indirect lighting at the present stage of its development.

There are, of course, special types of direct and semi-indirect fixtures in which the density of the glass is sufficient to prevent objectionable glare. Unfortunately, however, almost all of the strictly commercial units of these types are so objectionable for low ceilings, and particularly when used with the larger sizes of nitrogen-filled tungsten lamps, that their use must result in discomfort and ultimately in permanent injury to sight.

A step in the right direction has been made by the development of the so-called luminous bowl fixture, in which the superior qualties of the regular indirect system are realized. An under bowl serves to transmit a very low degree of light to the floor, thus rendering the light source "apparently" visible, and thus satisfying the taste of certain individuals who feel that completely to conceal the light source renders the system unnatural and cold in its appearance.

Another interesting case of direct lighting is shown by Fig. 5, where "linolite" units are employed. The large extent of the light sources, backed by the white ceiling, tends to relieve the glare which would be produced were the candlepower all developed by a few concentrated lamp filaments. In Fig. 6 another application of the "linolite" unit is shown in a board room, where the effect is rendered very pleasing by the light-tinted walls and ceiling. As a general proposition, however, the use of wall brackets as suggested by this view is decidedly inferior to the overhead scheme.

Semi-indirect illumination with fairly large nitrogen-filled lamps is used in the office represented by Fig. 7. Here an intensity of more than 6 ft.-candles is produced from an installation of 1.5 watts per square foot, or more than four effective lumens per watt, which compares very favorably with the older vacuum tungsten lamps when used with efficient reflectors of the direct-lighting type. The light transmitted through the under bowls of the units used in this office tends to increase



FIGS. 10 AND 11—SPECIAL CASES OF OFFICE ILLUMINATION. A TROUGH REFLECTOR IS EMPLOYED FOR LIGHTING THE WALL-TYPE FILING CASE IN FIG. 10. THE ADDING MACHINES IN FIG. 11 ARE ALSO ILLUMINATED BY A TROUGH-TYPE REFLECTOR

The influence which the mounting height has on the qualities of the lighting system should also be considered. What has just been said relative to the objectionable features of the direct and semi-indirect schemes applies fundamentally to the office of moderate ceiling heights, ranging, say, from 10 ft. to 14 ft. (3 m. to 4.2 m.). For interiors having considerably higher ceilings there is much less likelihood that the brilliancy of reflectors and translucent globes will be objectionable than when the equipment is nearer the floor and consequently more often in the line of vision. Moreover, the direct-lighting system, even with low ceilings, when small units are employed, may sometimes be made very effective and quite free from glare.

To illustrate the foregoing points, several actual installations will be considered. An excellent example of a well-designed direct-lighting system with small units is shown by Fig. 4. This night view in a large office demonstrates the almost perfect uniformity which may be realized by the proper selection of reflectors in conformity with spacing distances and mounting heights. The illumination intensity in this office is about 10 ft.-candles, a value considerably higher than average practice, but which is practicable with the new nitrogen-filled lamps with their lower energy consumption for given values of luminous flux.

shadow effects slightly. The contrasts thus afforded, coupled with the fact that the light source itself is visible through the medium of the bowls, gives this

DATA ON OFFICE LIGHTING SYSTEMS (TUNGSTEN LAMPS)

System	Rating of Lamp (Watts)	Reflector or Fixture		Approximate Values for			
		Style	Type	Ceiling Height (Ft. and In.)	Lamp Height (Ft. and In.)	Watts per Sq. Ft.	Intensity, Foot-Candles
General offices:							
Direct	60	Holophane	Intensive	10–0	9–6	1.44	3.9
Direct	60	Holophane	Concentrating	10–8	10–0	1.16	3.6
Direct	60	Holophane	Intensive	10–8	10–0	1.44	4.4
Direct	60	Holophane	Concentrating	10–8	10–0	1.48	3.2
Direct	60	Holophane	Intensive	10–9	10–0	1.00	4.5
Direct	60	Holophane	Intensive	10–9	10–0	1.73	3.7
Direct	60	Holophane	Concentrating	13–0	11–6	1.35	4.3
Direct	100	Holophane	Intensive	.....	11–0	1.40	10.0*
Semi-indirect	400	Monolux	No. 3320	....	12–0	1.50	6.2‡
Indirect	100	X-Ray	.....	15–9	13–3	1.25	....†
Factory offices:							
Direct	60	Opal	Intensive	8–9	8–0	1.33	4.3
Direct	60	Holophane	Intensive	9–0	8–6	1.88	2.9
Direct	60	Holophane	Concentrating	11–6	10–9	1.52	5.4
Direct	60	Holophane	Concentrating	13–9	13–9	2.00	3.5
Direct	60	Holophane	Intensive	16–0	10–0	1.14	4.5
Direct	150	Holophane	Concentrating	16–0	14–0	2.04	3.5

*See Fig. 4. †See Fig. 7. ‡See Fig. 8.

system a sense of warmth or life which is lacking with the indirect method.

The latter feature can perhaps best be illustrated by

reference to Fig. 8, which shows a large office equipped with small indirect units, one lamp to each fixture. Where the illumination facilities are as exceptional as in this case, the slight tendency toward coldness in the effect of the room can hardly be classed as an objection of any magnitude. Fig. 9 gives an idea of the effect produced by and the general appearance of larger indirect units.

IMPORTANCE OF KEEPING SURFACES CLEAN

A factor of much importance when indirect units are used is the gross neglect which is so likely to occur in keeping the interior reflecting surfaces clean. Furthermore, with multiple-unit fixtures, where several lamps are housed in one inclosure, it is very easy to overlook a burned-out lamp. Such neglect both in cleaning and in making renewals tends to impair systems of this kind, sometimes in a remarkable manner. The only safe course to pursue is to establish a definite and rigid cleaning and inspection schedule and not to depend on the complaints of the office occupants.

Special cases of illumination are shown in Figs. 10 and 11. Local lighting of this type may not be required, however, where a properly designed overhead lighting system is employed.

ENGLAND WORKING TOWARD CENTRALIZATION OF POWER

Results of Providing Entire Industrial Community from Central Stations Placed at Economical Points and Near Coal

Discussing economic problems which will follow the war, Robert Fleming, chairman Investment Trust Corporation of London, said:

"Many committees are at work trying to strengthen or reconstruct our industrial fabric. The one that to my mind seems to promise the greatest results is that dealing with coal consumption and power production.

"The idea is to link up the whole country through central stations placed at the most economical points and near coal, thereby providing the whole industrial country with power and light at a minimum cost. Some of the results would be:

"(1) A saving in coal consumption reckoned at 50,000,000 tons per annum, and consequently an equal increase in our available export coal tonnage; (2) an enormous saving in coal transportation; (3) an immense addition could be made to our machinery export trade through the non-use of engines and boilers at home, and (4) with our own electric power machinery requirements a home product of sufficient volume we would be able to compete successfully with any other country in overseas electrical business.

"Our country is small, but it is compact. Coal is close to every large industrial center, and no center is far from a good shipping port. With these natural advantages, and with a comprehensive system of cheap power—discarding uneconomical plants—the whole industry of Great Britain would receive an impetus approved alike by protectionist and free trader. Nor is it a wild idea to suppose that our whole internal transportation system would have its power supplied from the same source, so making available for export to less favorably situated countries the bulk of the coal now used by our own railroads."

HANDLING THE COAL FROM THE CARS TO THE STOKERS

Method Followed by a Tennessee Operating Company in Remote Steam Station Situated Where Laborers Are Hard to Procure

BY J. A. LONGLEY
Engineer Tennessee Power Company

Since the Parksville steam station of the Tennessee Power Company is 16 miles (25.7 km.) from the nearest town, there is very little immediate labor supply to draw from; consequently the coal and ash-handling apparatus was designed to be operated with a minimum number of men. The coal cars are brought to the station yards over a private right-of-way, 6 miles (9.6 km.) long, from Ocoee station, the nearest railroad point.

From the foreign freight cars the coal is dumped into a concrete coal hopper which is flush with the ground.

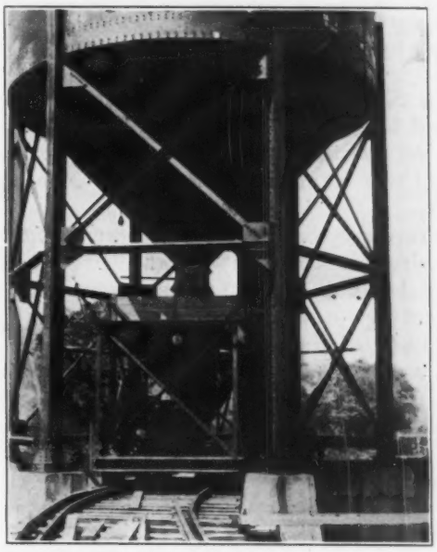


FIG. 1—TRAVELING COAL HOPPER UNDER STORAGE BIN

An inclined conveyor then takes the coal to a single-drum crusher, from which a bucket elevator hoists it into an overhead storage bin. This bin, which has a capacity of 300 tons (272.1 t.), is built of steel plates, is supported by columns and is lined with 3 in. (7.62 cm.) of concrete to prevent erosion. Running underneath the bin into the boiler room is a standard-gage track upon which a traveling coal hopper operates. The bottom of the coal bin is equipped with a valve, and immediately underneath the bin are platform scales for weighing the coal as it is loaded into the traveling coal hopper.

The traveling coal hopper was, in a measure, developed especially for this station. As shown by the accompanying detail drawing, it consists of a rigid channel-iron frame supporting a 4.5-ton (4-t.) pyramid-shape bin. The bottom of the bin has a sliding gate from which the coal discharges into a swinging screw conveyor driven through bevel gears by a 3-hp. motor. At one end of its travel (an arc of 80 deg.) the screw conveyor occupies a position underneath the bin, thus permitting the car to clear the columns of the overhead coal bin and the door to the boiler room. At the other end of its travel the screw conveyor overhangs

the side of the car and in this position discharges into the stoker hoppers.

The traveling coal hopper is propelled by a 5-hp. motor, which is connected by a double spur-gear reduction to one axle. A foot brake is provided which works on a drum mounted on the countershaft. The motors operating the screw conveyor and the main drive are

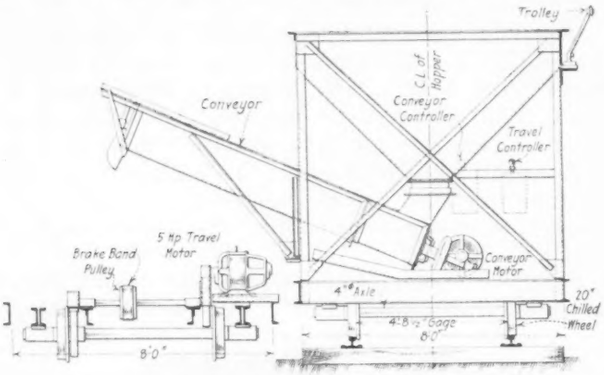


FIG. 2—DETAILS OF TRAVELING COAL HOPPER

both type SK Westinghouse motors designed for 1150 r.p.m. and 110-volt direct current. Energy is supplied through an overhead trolley wire. The coal-handling equipment was furnished by the Jeffrey Manufacturing Company.

This traveling coal hopper has been in nearly continuous service about eight months. It supplies eight 440-hp. Babcock & Wilcox boilers operating at 200 per cent of rating. Under maximum conditions 300 tons (272.1 t.) of coal are handled per twenty-four-hour day, which is equivalent to one round trip every twenty minutes. A round trip from the coal bin to the end boiler and back again is 750 ft. (228.6 m.), so it is apparent that the traveling hopper is kept busy, considering the time required to fill the stoker hoppers.

No record of the cost of operating the coal hopper

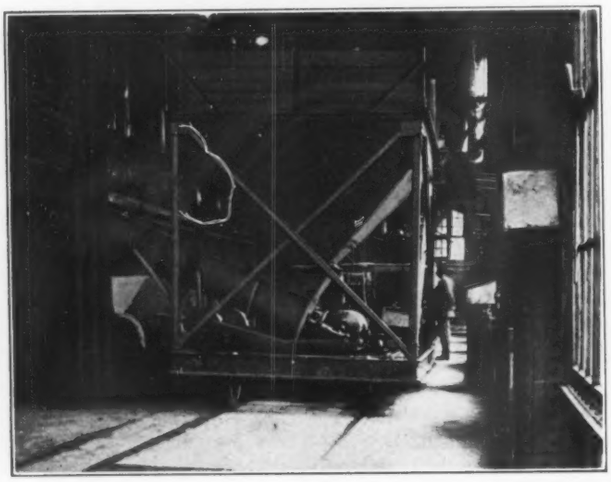


FIG. 3—TRAVELING COAL CHARGER FILLING STOKER HOPPER

alone has been kept. The total cost of handling the coal from the car to the boilers is kept, however, and this averages about 14 cents per ton (17 cents per t.). A large portion of the coal used by the station is delivered to the yard at a time when the storage bin is full. This has to be disposed of temporarily, so it is unloaded from a trestle and stored on the ground. From this point it is picked up by a locomotive crane and again loaded into cars and dumped into the coal hopper. This double handling may seem inefficient, but it makes possible the purchase of odd lots of coal at low prices. Notwithstanding this double handling the labor cost is not excessive.

Obviating the Apparent Disadvantages

Certain disadvantages have been experienced with this equipment, but they were due to lack of experience in this method of handling coal and can be easily corrected in other installations. For instance, the rigid base makes it necessary to keep the track in perfect alignment in order to avoid derailments. Moving the car for feeding stoker hoppers has been found to be very hard on the motors and controllers. The motors used are the standard-type open-end motors, consequently some trouble has resulted from dust—fully inclosed motors would have been better. The principal disadvantage of the traveling hopper from an operating viewpoint is that in case it breaks down there is no storage of coal available at the boilers, as would be the case with an overhead bin. In case of trouble with the car it is either necessary to drop load or move in coal by hand.

Except for the disadvantages mentioned, the car has proved very satisfactory and has accomplished what it was designed to do. It was low in first cost as it saved heavy steel work for supporting an overhead bin above the boilers. It saves conveyors and elevators in the boiler room where they would be in hot, inaccessible places. From an operating viewpoint it possesses the desired advantage of permitting coal to be weighed just as it is fired, putting the daily operation of the plant on the basis of a continuous test. The result has been that the operating expenses of the station have been closely watched, and economies have resulted that would not have been possible otherwise.

IMPROVED WAY TO RUN SYNCHRONOUS MOTORS

Motor Is Operated with Field Excitation Much Below the Amount Which Corresponds to Normal Excitation

In using a synchronous motor in connection with certain forms of alternating-current apparatus it is necessary that the motor run in absolute rotative-position synchronism with the generator supplying the alternating current, and further, that the synchronous motor shall respond very readily to any changes in the angular velocity of the controlling generator. Arthur R. Bullock of Cleveland, Ohio, in patent No. 1,223,472, shows that this condition can be arrived at by running the synchronous motor with the field excitation much below that corresponding to normal excitation. In running such a motor in this manner it has been found that the motor keeps in absolute synchronism with the generator whose alternating current it is using, and further, that the motor responds very quickly to any changes in frequency conditions which may occur on the line. So close is the regulation that a given point upon the rotor of a ½-hp. motor was found not to vary 1/32 in. (0.79 mm.) on a 7-in. (17.8-cm.) radius from a similar point upon the generator rotor.

THE USE OF FUEL OIL FOR STATIONARY PLANTS

Points for Consideration When Using This Fuel and Results Attained by Operating with Coal and Oil Fuels

BY FREDERIC EWING*

Fuel oil does not offer a universal solution to the problem of efficient power production, but it effects great savings in plants where the cost of coal handling is high, owing to location with respect to tidewater or rail delivery, or to inadequate coal-handling machinery, or to machinery whose installation is unjustified by the cost; where the fire-room labor cost is high; where limited boiler or stack capacity exists; where smoke regulations are strict, and in plants having long stand-by periods. The advantages due to fuel oil are high efficiency, resulting from perfect combustion with little excess air and even distribution of heat; high heat absorption, due to the cleaner tubes that may be maintained; no cleaning of fires required; low cost of handling fuel; low cost of maintenance, elimination of firing tools and grate bars; absence of dust, dirt and ashes; ease of regulation; saving in labor; increase of boiler capacity, and absence of smoke. Fluctuating loads can be handled with the utmost facility when using oil as a fuel.

On a 200-hp. return-tubular boiler about 3000 lb. (1360.7 kg.) of coal is used per week for banking fires at night and making new fires in the morning without doing any effective work. With fuel oil, only 310 lb. (140.6 kg.) of oil is required for this work. The cost of carrying two 500-hp. boilers in a New England plant on the line is $300 a week when using coal for banking only. With fuel oil one fireman can handle ten to fifteen boilers. Another New England plant equipped with fifteen Babcock & Wilcox boilers aggregating 5500 hp., with three eight-hour shifts per day, requires sixty-three firemen on the payroll when burning coal, but after changing to fuel oil the number was reduced to seven.

Usually from 10 to 75 per cent increased boiler capacity can be obtained with fuel oil, as the stack area required is only 60 per cent of that needed for combustion of coal.

The manner in which the oil-burning equipment is installed and operated is more important than the type of burner selected. Steam is generally used as the atomizing agent under stationary boilers, and is more economical than air atomizing. Mechanical burners require from 1.5 to 3 per cent of the total steam generated for operating the oil pump and heating the oil; steam-atomizing burners require from 2 to 5 per cent. The mechanical burner is far less flexible as to control than steam atomizing and requires more attention and cleaning. Power fluctuations require spare burners under the boilers when mechanical equipment is used; a higher draft is required, and in many cases to obtain smokeless combustion a blower must be used.

A fish-tail flame burner is most satisfactory as it spreads the oil out in a thin sheet and provides for the most economical use of air for combustion. If the oil is heated above its fire point before atomizing, it will disintegrate and tend to clog the burner; if heated insufficiently, perfect atomization is not obtained and imperfect combustion will follow. In a properly designed furnace the grate bars are removed and a firebrick floor with carefully planned air openings is laid on pieces of 2-in. (5.1-cm.) pipe extending across the fire box. The air supply is admitted through these floor openings. Perfect combustion should take place before the gases come in contact with the boiler-heating surfaces. Oil used for fuel should have a flash point not under 150 deg. Fahr. (65.6 deg. C.) so that it can be used with the same safety as coal.

Air should be regulated by the stack damper, leaving the ash-pit doors open at all times. Automatic damper regulation operated by gas pressure in the furnace is most economical. The most efficient draft at which an oil-fired boiler should be operated is from 0.01 in. to 0.06 in. (0.25 mm. to 1.5 mm.), depending on the capacity at which the boilers are operated. With properly designed furnaces the best results are obtained by running near the smoky point. Fuel-oil installations should, if possible, be in duplicate and should include cross-connected pumps. The speed of the pumps should be regulated by a diaphragm valve connected to the main steam line. A suitable oil heater should be used, the exhaust steam from the oil pump being utilized to heat the oil before it reaches the burners. Duplicate strainers should be installed on the discharge side of each pump.

COMPARATIVE BOILER TESTS WITH COAL AND FUEL OIL

Made at the Jenckes Spinning Company, Pawtucket, R. I., using two 520-hp. and one 460-hp. Babcock & Wilcox boiler

	Coal	Oil
Duration of test (hours)	24	24
Steam pressure (lb.)	107	120
Feed-water temperature (deg. Fahr.)	210	215
Factor of evaporation	1.042	1.039
Temperature of flue gases (deg. Fahr.)	448	440
Draft in stack (in.)	0.372	0.06
Carbon dioxide (per cent)	Not taken	13.5
Total water actually evaporated (lb.)	667,192	1,235,000
Total water evaporated from and at 212 deg. Fahr.	695,214	1,283,000
Steam pressure to burners (lb.)	....	50 to 60
Oil pressure to burners (lb.)	....	30 to 40
Temperature of oil at burners (deg. Fahr.)	....	130
Specific gravity of oil (Baumé)	....	14.7
Heat value of fuel as fired (B.t.u.)	14,600	18,300
Total fuel as fired (lb.)	69,390	84,376
Boiler hp. (builder's rating)	1045	1500
Boiler hp. (developed)	839	1550
Per cent of builder's rating	80.2	103
Water evaporated per pound of fuel as fired from and at 212 deg. Fahr	10.02	15.21
Boiler efficiency (per cent)	66.6	81.5

A circulating pipe system is also essential, so that when starting up the plant after the oil has been allowed to become cold in the pipes the burners can be bypassed and the oil circulated through the system and heater so that hot oil is supplied to the burners. Provision should be made for removing any condensation from the steam lines leading to the burners and the lines should be thoroughly insulated. In plants shut down on Sundays it is advisable to install a small auxiliary boiler which can be fired with wood or coal,

Under favorable conditions 1 lb. (0.45 kg.) of oil will evaporate from 14 lb. to 16 lb. of water (6.4 kg. to 7.3 kg. of water per kilogram of oil) from and at 212 deg. Fahr.; 1 lb. of coal will evaporate from 7 lb. to 10 lb. of water (3.2 kg. to 4.5 kg. of water per kilogram of coal), and 1 lb. of natural gas from 18 lb. to 20 lb.

* Abstract of discussion at Boston under auspices of A. I. E. E. and A. S. M. E.

of water (8.2 kg. to 9.1 kg. of water per kilogram of gas). About 3.8 barrels of petroleum are required to evaporate as much water as 1 ton (0.91 metric ton) of New River (West Virginia) coal. Data on the comparative evaporative powers of fuel oil and coals are published in the 1914 report of the United States Geological Survey on Petroleum.

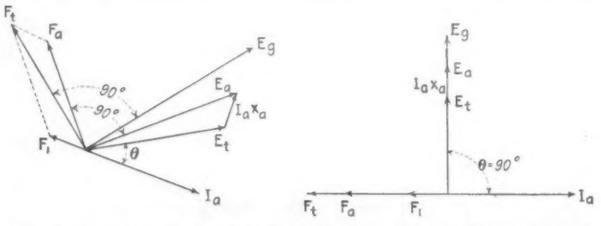
Tests on the boiler plants of four New England mills with coal and fuel oil show that under similar conditions 85 B.t.u from oil gives the same evaporation as 100 B.t.u. from coal, and that the fire-room labor cost is reduced 63 per cent, the cost of handling ashes also being saved. The details of a typical test are given herewith.

Graphical Determination of Alternator Regulation

Method Based on Potier's Scheme of Separating Armature Reaction and Reactance and Making Use of Power Factor of Load Directly

BY A. S. BLATTERMAN

SEVERAL methods have been suggested for determining the regulation of alternating-current generators under different load conditions which avoid the necessity of actually loading the machine. None, however, gives entirely satisfactory results when compared with test data unless the saturation characteristic of the machine is a straight line or nearly so. In most practical cases the emf. method indicates less than the actual values of regulation, while the mmf. method



FIGS. 1 AND 2—VECTOR DIAGRAMS FOR ALTERNATOR OPERATING WITH LAGGING AND ZERO POWER FACTORS RESPECTIVELY

The terminal voltage is represented by E_t, the current by I_a, and the armature leakage reactance drop by $I_a x_a$. This vector added to E_t gives the resultant voltage, E_a, generated by the air-gap flux, which is the resultant of the field and armature magnetomotive-forces. The demagnetizing effect of the armature mmf. is shown at F_i. F_a is the resultant mmf. producing the air-gap flux which generates E_a and is 90 deg. in advance thereof. F_t, the combination of F_a and F_i, represents the main field excitation. Owing to it there will be generated the voltage E_g, which exists at the terminals of the machine at no load.

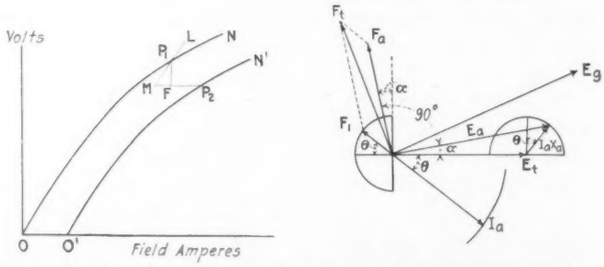
gives larger than actual values. Potier's method, which is really a combination of these two, gives results which are more nearly accurate than either of them. Calculation of regulation by use of the complex number seems hardly justifiable since the accuracy of the result is very doubtful at the outset.

To avoid some of the objections mentioned the writer has developed a graphical method which is quick to use and which at the same time gives results as reliable as can be obtained by calculation. It is based on the Potier method of separating armature reaction and reactance and makes use of the power-factor angle of the load directly instead of the angle between the armature current and the generated voltage, an angle which is never accurately, or even approximately, known at the start. The resistance drop is neglected because it is generally small compared with the other reactions and at all events is considerably overshadowed by the inaccuracies of the other (magnetic) assumptions.

From the relations shown by Figs. 1 and 2 it may be seen that the voltage regulation of the apparatus is the difference between E_g and E_t. This consists of two parts—the reactance drop $I_a x_a$ and the effective drop due to armature reaction. To determine the regulation therefore the first requirement is to determine the value of $I_a x_a$ and the armature reaction for a given current. This may be done by plotting the open-circuit and zero* power-factor characteristics (ON and $O'N'$ respectively) as shown in Fig. 3. Any two points, P_1 and P_2, which correspond to the same field excitation will then be separated from each other by a horizontal distance equal to the armature reaction and by a vertical distance equal to the leakage reactance drop.

Separation of Armature Reaction and Reactance

On the basis of the preceding analysis the armature reaction and leakage reactance may be separated as follows: Short-circuit the armature and adjust the field excitation so as to produce the required armature current. The field current for this condition is plotted at O' (Fig. 3). Load the machine with an underexcited synchronous motor, raise the field excitation to a point



FIGS. 3 AND 4—NO-LOAD AND ZERO-POWER-FACTOR CHARACTERISTICS AND VARIATIONS OF DIFFERENT QUANTITIES WITH POWER FACTOR

P_2F represents the armature reaction plotted to the scale of field amperes. P_1F represents the leakage reactance drop in volts. For any given load current, changes in power factor will cause the extremities of the vectors $I_a x_a$ and F_i to move along the arcs of semicircles of radii $I_a x_a$ and F_i respectively, in which θ is the phase angle of the load. F_a, the effective mmf. producing E_a, always moves so as to be at right angles with E_a. Its value changes with changes in the value of E_a, the relation between the two being represented by the magnetization curve of the machine. The vector sum of F_a and F_i gives F_t, the main-field excitation required for the given terminal voltage. This produces the voltage E_g, which can be determined from the saturation curve when F_t is known. E_g is, of course, the no-load voltage desired for calculation of regulation.

*The zero power-factor characteristic corresponds practically with that obtained under short-circuit conditions.

well up on the knee of the magnetization curve, maintaining the armature current at the same value as was used for the short-circuit test, and read the terminal voltage and field current. This locates the point P_2. Through P_2 draw P_2M equal and parallel to $O'O$ and from M draw a line ML parallel to the open-circuit characteristic at the origin. A perpendicular dropped from the intersection of this line with the open-circuit curve gives P_1F $(= I_a x_a)$ and P_2F $(= F_1)$, the armature reaction in terms of field current.

The regulation of the machine will be predicated entirely by the magnitude and phase of these two quantities with the additional assumption that both are constant for the given armature current irrespective of saturation and power factor. In the problem usually encountered the load current, power factor and terminal voltage of the alternator are given and it is desired to know to what voltage E_t will change if the load is entirely removed. A closely allied factor is the field

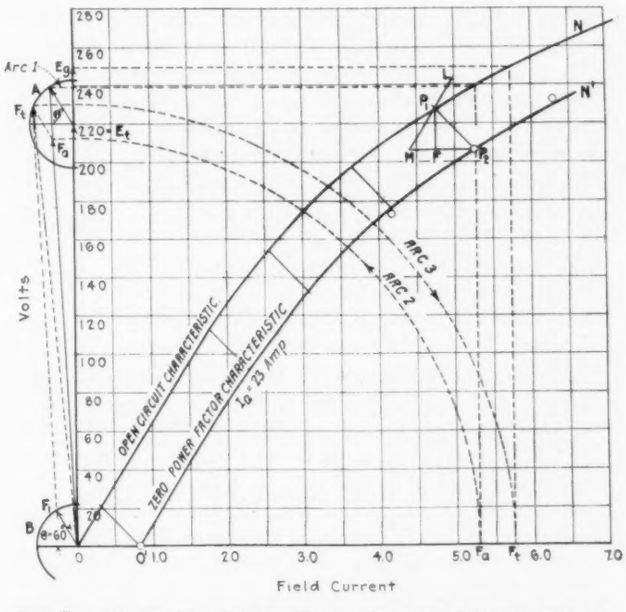


FIG. 5—GRAPHICAL CONSTRUCTION FOR DETERMINING REGULATION OF ALTERNATOR AT FULL LOAD AND 50 PER CENT POWER FACTOR

current. To what value must this be adjusted to produce the rated terminal voltage under load?

Reference to Fig. 4 will show that the angle α between F_a and a vertical to E_t is always the same as the angle between E_a and E_t. It is therefore possible to swing the emf. vectors ahead through 90 deg. so that E_a and F_a lie in the same line and E_t is laid off vertically. This makes it possible to handle the vector diagram together with the saturation curve on one sheet of paper in a graphical construction which at once determines the regulation and the necessary field excitation.

METHOD OF MAKING GRAPHICAL CALCULATION

Thus, in Fig. 5, lay off E_t equal to the given terminal voltage under load and draw the semicircle A with radius $I_a x_a$ $(= P_1F)$ as determined by the Potier method previously described. Describe the second semicircle B with its center at the origin O and radius equal to the armature reaction F_1 in terms of field amperes $(= P_2F)$. For any given phase angle of the load such as θ draw the radii F_1 and $I_a x_a$ in their respective circles parallel to each other and at an angle θ with the horizontal. Draw E_a and, with this as a radius and the center at the origin, swing the short arc 1 to cut the vertical axis of emfs. Project this point horizontally to the open-circuit curve and vertically down to the axis of field excitation, thus locating F_a, which produces E_a. With radius OF_a swing arc 2 to cut the line of E_a, locating thereon the field excitation F_a in its proper phase and magnitude with respect to the armature reaction F_1. Combine F_1 and F_a to obtain the total field excitation F_t and return this to the axis of field current through the arc 3. The ordinate to the open-circuit curve at this point gives the value of E_g, the total generated (no-load) voltage. The regulation is then $(E_g - E_t) \div E_t$. The construction also shows the value of field excitation, F_t, required to maintain the terminal voltage, E_t, under given load conditions.

COMPARISON OF ACTUAL PERFORMANCE WITH RESULTS OBTAINED BY GRAPHICAL METHOD

To test the accuracy of the graphical method described, the following test data were obtained on a three-phase, 15-kva., 220-volt, 60-cycle delta-connected machine. As a more severe test only one phase of the armature was used, the other two windings carrying no current.

(1) Careful determination of the saturation characteristic of the machine yielded the curve ON (see Fig. 5).

(2) With the armature short-circuited the field current required to produce full-load armature current (23 amp.) was 0.83 amp.

(3) While the alternator was loaded with an under-excited synchronous motor, the armature current was maintained constant at full-load value (23 amp.) and the field current was varied. Data were obtained as follows:

I_{field}	1.9	2.82	4.18	5.26	6.3
E_t	82	123	172	206	233

From this and the short-circuit data (2) the zero power-factor characteristic was constructed by the Potier method as shown in Fig. 5. Only one of the points is actually needed.

(4) With the machine loaded with resistance and variable reactance in series, the power factor was adjusted to two different values, the terminal voltage being set at 220 volts for full-load current in each case. The load was then disconnected and the rise in voltage noted. The results were as follows:

Cos θ	E_t	I_a	E_g (No Load)	Regulation (Per Cent)
0.5	220	23	251	14.1
0.87	220	23	237	7.7

By the graphical construction (Fig. 5) the values of E_g and regulation for the two preceding power factors are as follows:

Cos θ	E_g	Regulation (Per Cent)
0.5	549.5	13.4
0.87	238	8.2

The construction for cos θ = 0.5 is shown in full in Fig. 5. It may be seen that the two sets of results agree very closely. The check has been found to be generally better for three-phase machines than for single-phase machines.

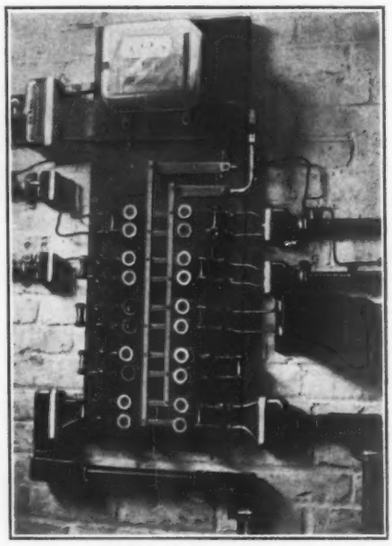
STATION AND OPERATING PRACTICE

A Department Devoted to Problems of Installation, Operation and Maintenance of Equipment for Economical Generation and Distribution of Electrical Energy

COMPACT STATION-SERVICE PANEL

Circuits Terminate in Condulet—Portable Lamp Tap and Bell-Ringing Transformer

A compact station-service panel in use at the Birchem Bend (Mass.) station of the United Electric Light Company is illustrated herewith. The feed wires and meter are at the top, and on each side of the busbars the usual taps are made for local service through fuses and knife



SWITCH AND METER PANEL FOR STATION SERVICE

switches, with short connections to condulets. A bell-ringing transformer is mounted at one side, and on the other provision is made for inserting a screw plug into a fuse receptacle for portable lighting on the gallery. The left-hand switch terminals in the latter case are short-circuited by copper wire, the line being broken only at the receptacle. A single fuse plug is used.

WATER RHEOSTAT FOR STARTING HOIST MOTOR

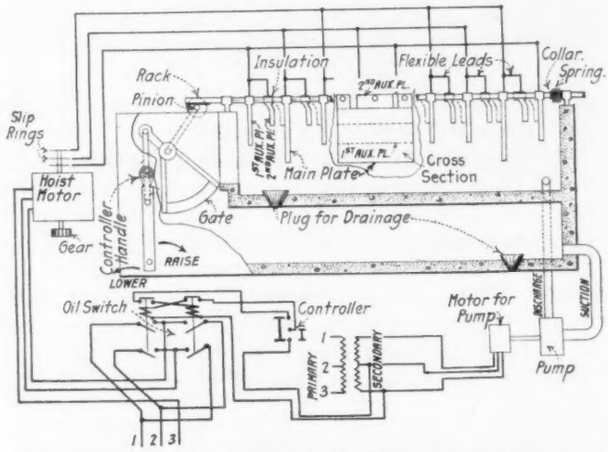
How an Emergency Starting Rheostat Was Constructed to Avoid Delay in Waiting for Apparatus to Replace That Destroyed by Explosion

BY FRED DUBRUIEL

The starting rheostat described and illustrated herewith was developed by the writer when called to a mine where an explosion of an air tank had wrecked almost all of the resistance boxes used in connection with a hoist motor. It was necessary that service be resumed in as short a time as possible and it was out of the question to wait for the manufacturer of the destroyed apparatus to replace the resistance boxes. Consequently a double-compartment concrete-tank water rheostat was built in which the electrodes are held stationary (vertically) and the electrolyte level is varied to change the immersion of the plates. The change in elevation of the electrolyte is accomplished by pumping water out of the lower compartment into the upper one and adjusting the crest of a spillway. The metal parts were made and fitted together while the concrete was drying. In six days the rheostat was complete and in service.

To operate the rheostat the controller handle is moved to the right, thereby partly raising the gate and allowing the water to raise and immerse the main plates. By moving the controller handle to the second notch the water will rise enough to immerse the first auxiliary plate, thus allowing the motor to gain speed more rapidly than if only the main plates were immersed. With the controller in the third notch the gate is raised still further and the second auxiliary plates are immersed. Further movement of the controller automatically shifts the second auxiliary plates to the position shown by the dotted line, where the secondary circuits are short-circuited. By changing the gap between the second auxiliary and main plates good speed regulation of the motor is obtained. The pump is kept running continuously, thereby causing a steady flow of water which keeps the plates cool, the water pasing over the gate having time to cool before it reaches the upper compartment again. With the construction employed a wide range of resistance is obtained in fairly compact space. The wide range of resistance is possible since the main plates which are immersed are very far apart.

The dimensions of the plates are as follows: Main plates, 18 in. by 12 in. by ½ in. (45 cm. by 30 cm. by 1.27 cm.); first auxiliary plates, 18 in. by 9 in. by ½ in.



CONSTRUCTION AND CONNECTIONS OF EMERGENCY RHEOSTAT

(45 cm. by 22.8 cm. by 1.27 cm.); second auxiliary plates, 18 in. by 5½ in. by ½ in. (45 cm. by 13.9 cm. by 1.27 cm.). All of the plates are made of soft steel. Starting with water at 20 deg. C., the temperature of the electrolyte will rise to about 33 deg. or 35 deg., sometimes 37 deg., with the gate in the first position.

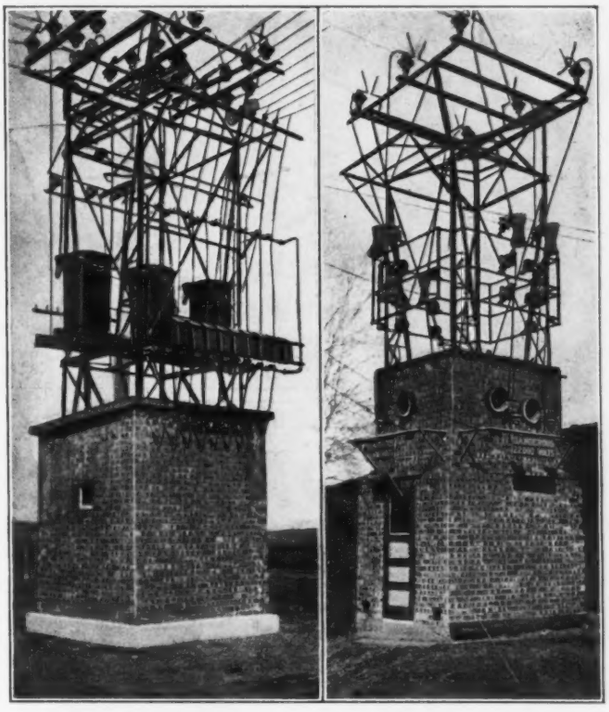
During the next step the temperature of the water is about 27 deg. or 30 deg., sometimes as low as 26 deg. During the third step the temperature is between 26 deg. and 28 deg. A difference of about 3 deg. to 7 deg. exists between the temperatures of the upper and lower compartments.

It should be pointed out that the handle which operates the rheostat gate also actuates the electrical controller which starts, stops and reverses the hoisting motor. It is impossible to operate the hoisting motor without first energizing the transformer which operates the circulating pump motor, as the relays controlling the hoist motor are energized by the secondary of the circulating pump transformer.

OUTDOOR SUBSTATION COSTS

Data Based on Supplying Commercial Energy in Conjunction with Railway System

Commercial light and power business has been developed by the Des Moines (Iowa) Inter-Urban Railway Company in conjunction with the operation of its 74-



FIGS. 1 AND 2—OUTDOOR SUBSTATION SERVING SMALL TOWNS; SPECIAL TOWER INTERCONNECTING POWER SYSTEMS

mile (119-km.) railway system. In so far as possible the lighting business is a wholesale one, the retail lighting representing only a small portion of the total. The power business, on the other hand, is thus far done on a retail basis. To date, light and power are being furnished to six small towns either on the right-of-way or a short distance from it. The power business is confined at present to supplying several coal mines, a gravel pit and washer and a large canning factory, each of which requires from 6000 kw.-hr. to 25,000 kw.-hr. per month.

One of the substations in use is shown in Fig. 1. The tower is built of galvanized-steel angles and channels and iron pipe. The equipment was furnished entirely by the Delta-Star Electric Company, and was shipped knocked down to the point where it was to be erected. The tower is provided with three mast arms to facilitate the removal of transformers for repairs, etc.

Fig. 2 shows a standard tower arranged to accommodate a 22,000-volt sectionalizing switch and meter-

SUBSTATION CONSTRUCTION COST

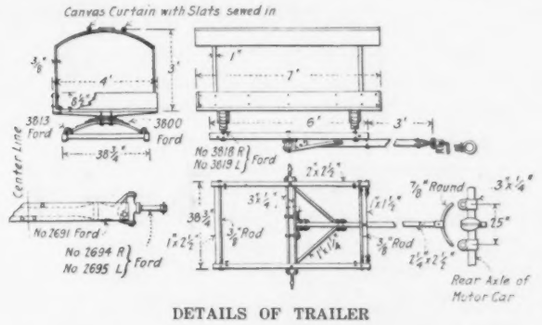
One steel tower, f.o.b. cars Des Moines	$400.00
Loading and hauling material	18.76
Foundation, labor and material	71.88
Erecting tower, labor	84.29
Connecting and cutting in	7.31
Finishing	42.98
Setting transformers	41.92
Brick structure, material and labor	150.00
Metering equipments, etc., installed	150.00
Transformers, three, 20 kva	500.00
Total	$1,467.14

ing and remote-control equipment. Through this station power is either supplied to or taken from the transmission line of the Fort Dodge, Des Moines & Southern Railroad. The oil switch is operated by a solenoid remotely controlled from a substation 3 miles distant, power being supplied to the closing coil direct from the 600-volt trolley wire. It will be noted that the arrangement of this tower has been changed to accommodate both an incoming and outgoing line of high potential by eliminating the air-break switch at the top of the tower. This work has been carried on under the direction of F. C. Chambers, electrical engineer of this company.

TRAILER INCREASES VALUE OF COMPANY'S RUNABOUT

Runabout Hauls Trailer to and from Locality Where Work Is to Be Done—Trailer Built from Front Axle and Spring of Ford

By an investment of about $50 in a trailer, the Elmira (N. Y.) Water, Light & Railroad Company has greatly increased the service that can be rendered by its Ford runabout. In using this outfit the desired equipment is piled into the trailer and the runabout hauls it to the scene of action, where the trailer is left and the Ford is free for other purposes. Several jobs



DETAILS OF TRAILER

may have to be done in the same locality, in which case the workmen can readily push the trailer from one point to another. When the work is completed the runabout comes around and hauls the trailer back again.

The construction details of the trailer are shown in the drawing herewith. It was built of the front axle

and front spring of a Ford car and will carry 900 lb. (408 kg.) on pavement. To hold the car rigid when standing two hinged props are provided on the rear of the body. A similar prop is provided in front to hold up the tongue.

TELLTALE LAMPS ATTACHED TO FEEDER CIRCUITS

Used to Indicate Interruption of Service, Cables Ready for Service and for Synchronizing Purposes

Having been delayed several times by defective telephone connections in locating faulty cable, the Pacific Gas & Electric Company has devised a new method which dispenses with the telephone, or at least utilizes it only as a supplementary means. Potential transformers have been installed on the power-house cables ahead of switches, current coils and all auxiliary apparatus. The low-potential side of each potential transformer feeds a lamp installed on the control panel for the corresponding feeder or cable. Thus, after a service interruption, a glance at the board shows what leads have been affected, the burning lamps indicating what cables are available for immediate service without waiting to get in touch with the operator in any substation or the power house.

It has been found desirable to connect the secondary side of these potential transformers to a synchronizing busbar by means of suitable receptacles to permit synchronizing the cables directly and do away with the synchronous motor set ordinarily used to accomplish the same results. By using six-point receptacles it is possible to register the voltage on each cable at all times on the control board.

This scheme has been found so effective that it has been made standard throughout the system and is now considered a most effective means of synchronizing and checking voltages.

LIGHTNING PROTECTION FOR OUTDOOR SUBSTATION

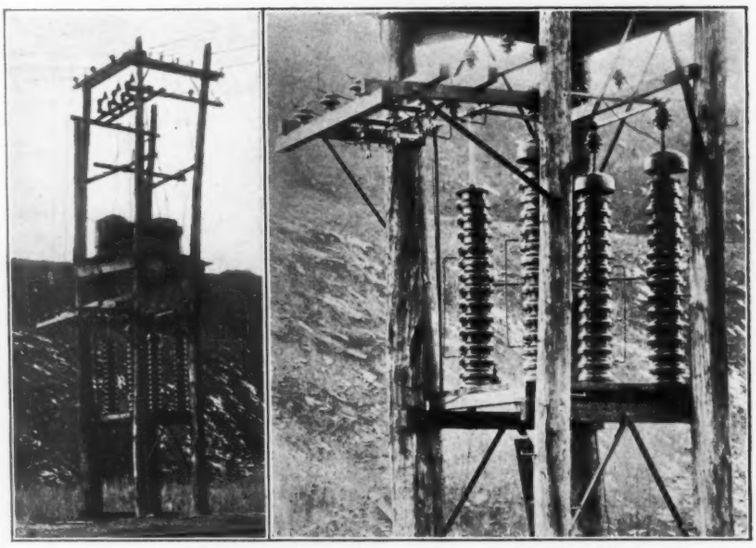
Liquid-Electrode Arrester Used Which Consists of an Air Gap in Series with a Number of Electrolytic Cells Between Each Line and Ground

BY JOHN O. MONTIGNANI

General Manager Despatch Heat, Light & Power Company, East Rochester, N. Y.

An interesting type of lightning arrester has been placed in service at the outdoor substation of the Rochester & Pittsburgh Coal & Iron Company, Genesee Docks, Charlotte, N. Y. The line supplying this installation is a branch from a 11,000-volt, 25-cycle main line, and on account of its exposed location has been peculiarly subject to the effect of lightning disturbances. After investigating the merits of various types of lightning arresters, the Rochester (N. Y.) Railway & Light Company decided that an aluminum-cell arrester which requires charging daily would not be a suitable device for this installation, and that the type described here gave promise of the best protection.

This device, known as the liquid-electrode arrester, consists of an air gap in series with a number of electrolytic cells between each line and ground. One electrode of the air gap consists of a metal sphere and the other of an umbrella-shaped hood placed over it to protect the gap from the weather. The hood is mounted eccentrically so that by turning it the gap can be varied according to the setting required. Columns of tile sections which serve as separators for the vessels in which the electrolyte is placed form the remaining part of the arrester. The tiles also protect the cells from the weather. Connections between adjacent electrolyte vessels are made by central metal electrodes extending from the bottom of each vessel to the surface of the electrolyte in a vessel below. This arrangement closes the circuit between the arrester gap and ground.



OUTDOOR SUBSTATION EQUIPPED WITH LIQUID-ELECTRODE ARRESTERS

When lightning causes a discharge across the gap, the generator current following blows the electrolyte away from the tips of each electrode for an instant, opening the circuit and extinguishing the arc. As the arcing takes place between a metal and a liquid electrode, the tendency of the metal vapor to maintain the arc is eliminated.

CONSTRUCTION OF ARRESTER AIR GAP

It is impossible to maintain any alternating-current arc with a liquid as an electrode except at a very high voltage per cell, much higher than that at which the cells of this arrester are operated. This is due to the low vaporizing point of water in the electrolyte and the impossibility of heating the water to a temperature that will throw off conducting ions. Any arc which is formed is extinguished at the end of the half cycle at which it takes place and the arrester is then ready for a subsequent rise in voltage if it occurs. The arrester was furnished by the General Electric Company.

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A Department Devoted to Commercial Policy and Management Topics, Including Applications of Electric Light, Power and Heat

A BIG POWER USER'S IDEA OF BUYING ENERGY

Brooklyn Company Points Out That Central Stations Are Willing to Back Their Sales Arguments with Definite Propositions

It is not always easy to obtain a free expression of what a power user really thinks about central station service. The Bush Terminal Company, Brooklyn, N. Y., served by the Brooklyn Edison company, published, without the knowledge of the central station company, in a recent issue of its bulletin, *The Bush Magazine*, under the title of "Buying Power Under Guarantee," an article showing that central stations are willing to back their sales arguments with definite propositions. Coming as it does from one of the largest power users in the United States, this article is naturally of more than passing interest to the power salesman and the commercial manager.

In part the article says:

In view of present-day difficulties with coal supply, many manufacturers are for the first time giving serious study to the proposition of buying power from a central electric station.

Too frequently in the past central stations were not given a really fair chance to ascertain whether or not they could save the manufacturer money. This was not always the manufacturer's fault. The central station power salesman, partly or wholly ignorant of the details of the manufacturer's operating conditions and power requirements, would make a proposition or suggestion so vague or so contrary to facts that there seemed no advantage to the manufacturer in going into details. On the other hand, it frequently has happened that the manufacturer resented even an implication that his private power plant might not be the best in the world, and refused point-blank to listen to argument or examine proof.

A very successful power salesman stated at a recent electrical convention that his hardest task is to induce manufacturers to ascertain what their own private plants really cost to operate. Items which should be charged against the cost of privately generated power are lost under general headings such as "supplies." . . . The private power plant, in other words, is very frequently a sort of "grafter" which lives partly or largely upon items charged to other departments of the business. Ninety-nine times in every hundred this condition is not appreciated by the manufacturer—also, ninety-nine times out of a hundred he resents being told the truth by the power salesman. He looks upon such assertions as a reflection upon his managerial ability.

It must be realized that the sale of power by a central station is, first of all, a business proposition. The electric company, like the manufacturer, is in business to make money—and, we may add, it has as much right to make money as the manufacturer has. To make money the electric company must sell its power, and it is just learning that the best way to sell power is by guaranteeing the cost of service.

That is to-day the electric company's proposition. If you will tell it, or let it find out, exactly how much your power now costs, it will tell you exactly how much you can save by using central station service and it will give a fair guarantee to back its assertion. The difficulty is, and always has been, to find out the exact truth about private plant generating costs.

The manufacturer frequently has said that buying power through a meter is like buying "a pig in a poke." He has wanted to know in advance exactly what he was to pay. Then immediately he turned the "pig in a poke" argument wrong side about by refusing exact facts about his private plant and asking the central station to make a definite estimate of costs based upon guesswork. But the present coal situation is changing all this. It has made many a manufacturer give thought to learning the actual truth about his power plant instead of accepting rough guesses, and just as soon as the manufacturer does that, the proposition of buying ready-made power takes on a practical aspect.

DEMONSTRATIONS AS A MEANS OF EDUCATION

Churches and Women's Clubs Offer Opportunities for Gathering Together Many Who Can Be Interested in Electrical Ways

There is no doubt that demonstrations of electrical appliances and their method of operation are too little used by the central stations in their educational program. The great value of these demonstrations, it is evident, is not in the immediate sales results, although they are appreciable, but rather is in the education of the public in electrical ways of doing things. The public has to be educated; on that point there is no question.

Central station electric shops and offices offer one class of places for holding these demonstrations, but there are other places, such as church parish houses and the rooms of civic and women's clubs, that offer possibly greater opportunities for gathering women together. As an indication of the value of this class of demonstration place, there follows a list of such places at which the Montclair (N. J.) district of the Public Service Electric Company has held demonstrations in the last few weeks, together with the attendance at each demonstration:

The Women's National League of North Fullerton Avenue Methodist Church, Montclair	70
St. James' Parish House, Upper Montclair	75
Verona Chapter Red Cross, Verona Methodist Episcopal Church	40
Montclair Women's Club, Spaulding High School	275
Federation of Women's Clubs, North Fullerton Avenue Methodist Church	100
Unity Church of Montclair	100
Union Christian Congregation Church, Cooper Avenue, Upper Montclair	200
State Delegation of Associated Charities, Commonwealth Club, Upper Montclair	450
First Baptist Church, Montclair	65

These demonstrations were conducted by Mrs. E. Hampton, appliance representative of the Montclair district, who displayed a complete line of electrical appliances, coffee being served in each instance, made with the electric percolator. Before each meeting the president of the society announced the exhibit and the assistance given by the Public Service Electric Company, which was enthusiastically received. These demonstrations afforded the representatives of the company

exceptional opportunities to meet the public upon a different footing from that afforded by their regular work. Many friends for the company have been made, valuable leads have been secured, and the following appliances were sold during the demonstrations: Two sewing machine motors, one grill, four vacuum cleaners, three electric sewing machines, one percolator and eleven flatirons.

DETROIT EDISON CHANGES TO BI-MONTHLY BILLING

Labor Shortage Brought About by Government Needs for Army and Navy Force Company to Conserve Available Supply

Beginning with the current month, the Detroit (Mich.) Edison Company will bill residence customers on a bi-monthly basis. The minimum charge of 50 cents per month will be changed to $1 for the two-month period, and the number of kilowatt-hours formerly billed at the primary rate of 14 cents will be doubled.

Customers were advised of the change by a post-card announcement, which is here reproduced. A reproduction of the new form of bill is also shown.

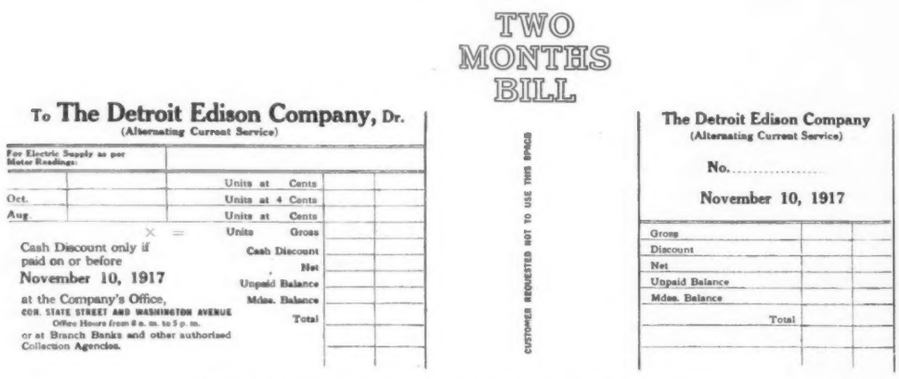
Detroit, July 1, 1917.

Please be advised that your residence electric meter will be read every two months after the June reading instead of every month as heretofore (your meter will not be read in July). Your bills will accordingly fall due every other month, the last day for cash discount being as follows:

September	20, 1917	March	20, 1918
November	20, 1917	May	20, 1918
January	21, 1918	July	20, 1918

THE DETROIT EDISON COMPANY.

POST-CARD ANNOUNCEMENT SENT TO EVERY CUSTOMER



NEW BILL FORM USED BY DETROIT EDISON COMPANY

The principal reason for this action is one concerning labor, as is set forth in the accompanying letter, which is a copy of the one sent to the Detroit Common Council announcing the new plan and the reasons therefor:

May 11, 1917.

To the Honorable Common Council of the City of Detroit.

Gentlemen:—A number of the employees of this company have since the beginning of trouble joined the army and navy; others have been called out as members of the Naval Reserve or to officers' training camps, and a number are under warning that they may be called any day. This is the condition *before* any call under the new army law, and inasmuch as the average age of our employees is thirty-two years, we shall certainly be required to release a great many men to the military service of the nation.

It will be impossible to replace all these men and difficult to replace any large part of them. Up to the present time our serious troubles have been the high cost of coal and of construction material and the difficulty of getting these. Now we are going to be short of help.

Like every person and corporation in the country, we also face the necessity of economical operation in order that we may carry the burdens directly or indirectly to be laid upon us by the entrance of the United States into the war.

Following our custom of discussing with the Common Council in advance any change in our operations in which the general public will be concerned, we respectfully ask your attention to the following:

We have in Detroit and in the adjacent villages over 123,000 customers using electric light for their residences. The average annual payment by each of these customers was in 1916 $18.66 net. We rendered to each of these customers twelve bills, the average monthly bill being, obviously, $1.55. We now propose to render bills for residence service every second month—customers on the west side of Woodward Avenue receiving bills in July, September and November, and so forth, while customers on the east side of Woodward Avenue will receive bills in August, October, December, and so forth. This change, with the present number of customers, would save us in each year the labor required for 738,000 meter readings, the figuring and making of the same number of bills, and would save customers 738,000 trips to pay bills, or else writing and paying postage on checks in the case of those of them who pay by check.

We think that the saving of time to Detroit people is worth while, and we have not been able to figure out that any harm would be done to the public. We stand to lose a little money by defaulting customers getting away with two months' service, instead of one month, but we will take our chance on that. Such losses are very small in Detroit.

It does not appear that our proposal requires any official action by the Common Council, but we respectfully ask that this communication be referred to the appropriate committee with authority to consider the details with us and to advise us for the common good. Yours truly,

THE DETROIT EDISON COMPANY,
Alex Dow, President.

CHARGING FOR WORK ON CONSUMERS' PREMISES

Statement Made That Little or No Difficulty Will Be Experienced in Convincing Customers of Fairness of Policy

There is an enormous amount of money being spent by central stations throughout the country for work done on consumers' premises without charge, and as a matter of sound economy this policy is receiving more attention on account of the new high levels of cost of material and labor.

At the recent mid-year convention of the Empire State Gas and Electric Association, J. P. MacSweeney, of the Rochester Railway & Light Company, advocated

that when a trouble man is sent out on a "light's out" complaint and he finds the trouble is caused by defects in the consumer's lighting system, such as blown fuses, a charge of 25 cents for the call, plus the retail price of the fuses, may properly be made. "To be sure," the paper stated, "it will be found necessary to answer a few questions as to the 'why' and 'wherefore' of such a charge, but little or no difficulty will be experienced in convincing customers as to the fairness of the policy in this regard. So long as the principle involved in charging for this work is just, then we need only be concerned with the fairness of the charges made and the methods used in initiating them. Charging amounts that could reasonably be construed as favoring the idea of getting all that the traffic will bear must be avoided, and we must remember that we have educated the public to expect more than is just and equitable and that therefore we should not expect consumers to assimilate agreeably in one gulp the difference between a free service and one for which they must pay. The educational process should be a gradual one, and experience proves that this question of charging for work on customers' premises heretofore done free is much less dangerous than most of us think it is."

FACTORS IN NEW BUSINESS DEPARTMENT ORGANIZATION

Responsibilities and Duties of a Central Station Sales Manager—Ideas on the Conduct and Activities of Salesmen

Speaking before the commercial men of the Indiana Electric Light Association, Thomas Donohue, manager of the General Service Company, Lafayette, Ind., reviewed the considerations which face the central station manager when he is confronted with the problem of inaugurating a commercial department.

"The most important factor in a new-business organization," said Mr. Donohue, "is the head of the department. Every new-business organization should have some one who is responsible for the results of the department. The title given this particular person does not in any way affect his duties or responsibilities. It makes no difference whether he is called commercial agent, sales manager or new-business manager. However, the success of the department depends entirely on his ability.

QUALIFICATIONS OF THE DEPARTMENT HEAD

"The person selected for the head of the department should be a man who has had previous experience and is familiar with the modern systems and practices in the sale of appliances, and he should be familiar with the office and accounting end of the business in so far as it applies to the sale of appliances. He should possess a practical as well as a theoretical knowledge of domestic, industrial and commercial lighting, sign lighting and house wiring.

"He should be a man capable of analyzing a power installation and should be able to make proper recommendations. He should have a personality that will create a favorable impression among the general public, as well as one which will insure obedience and respect from the personnel of the organization.

"The sales manager should be responsible only to the manager of the company. He should manage his department as though it were a separate business and upon sound business principles. He should purchase the material and appliances required and price them according to good business practice, with the view of not conflicting with the business of local dealers in these appliances.

"He should keep in close personal contact with the local electrical dealers and contractors and co-operate with them in every possible manner, assuring the company of their support rather than their enmity. In all matters not affecting the general policy of the company he should be empowered to make such decisions as his judgment dictates and be assured of the support of the management. He should receive the full and hearty co-operation of the rest of the organization from the manager down, for without this co-operation he will be able to accomplish but little.

CONDUCT OF SALESMEN

"The central station salesmen should be possessed of good appearance, be sober, honest and industrious. They should be responsible to the new-business manager, and to him only. Any information or instructions from the rest of the organization should be transmitted through the manager to enable him to keep in close touch with the work.

"Salesmen should report for duty at 8 a. m. to receive their instructions and the list of prospective customers in time to reach their territory at 9 a. m. It is not advisable to make any residential calls in the morning, except by appointment, after 11.30 o'clock, since at that time housewives are preparing the noonday meal and do not always take kindly to an interruption which might be welcome at another hour.

"The time to return after lunch is at 1 o'clock or shortly thereafter, as in good weather women wish to go out about 2.30 or 3 p. m. At this time the calls in the business district should be made, except those on the retail merchants, until about 4.30, when the salesman returns to the office and reports the results of the day's work.

"In case of rainy or bad weather, it is not advisable to make any calls in the residential section except by appointment. In view of the fact that trade will at this time be dull, an excellent opportunity is offered to call on the retail merchants. Otherwise these calls should be made in the morning before going to the regular territory. In addition to the 'prospect' calls, the salesman should make from ten to fifteen regular calls each day, turning in a card for each call, containing in accurate form the information requested.

PROPORTION OF SALESMEN TO POPULATION

"One salesman should be employed for each 10,000 inhabitants, whether the company is operating a combination gas and electric property or not. Each should be assigned to definite territory, and all inquiries arising from this district should be referred to the salesman for his attention. His results should be reported daily to enable the manager at all times to know accurately what is being done."

In his paper Mr. Donohue also discussed office location and management, the residential survey, the commercial survey and the power survey, bringing out facts and making interesting recommendations on these points.

ADVANCE IN TECHNICAL THEORY AND PRACTICE

Including a Digest of Important Articles Appearing in the Scientific and Engineering Press of the World

CHARACTERISTICS OF IRON WIRE FOR TRANSMISSION PURPOSES

Relative Advantages Derived from Three Kinds of Iron Wire—Not a Great Deal of Improvement to Be Expected from Steel Alloys

BY L. W. W. MORROW
Associate Professor of Electrical Engineering, University of Oklahoma

EXPERIMENTS to determine the electrical and mechanical constants* of stranded iron-wire conductors such as may be used for transmission purposes have been conducted at the University of Oklahoma, the results supplementing such data as have already been compiled. Three kinds of wire were tested—¼-in. (6.4-mm.) E. B. B., ¼-in. (6.4-mm.) Siemens-Martin steel and 5/16-in. (7.9-mm.) standard Bessemer-steel messenger cable. Seven-strand conductors were used in each case. In order to approximate practical operating conditions a 1-mile (1.6-km.), single-phase, 2200-volt wood-pole line was constructed with conductors mounted 24 in. (61 cm.) apart on 2300-volt insulators. The line was built in the form of a loop so that measurements could be made on the generator and load end of the line with the same instruments.

The electrical test consisted of measuring the power input to the line, the impressed and terminal voltages, the line current, the efficiency of transmission, and the regulation. The impedance, effective resistance, ohmic resistance and reactance were calculated. Results of these tests are shown graphically in Figs. 1 to 3.

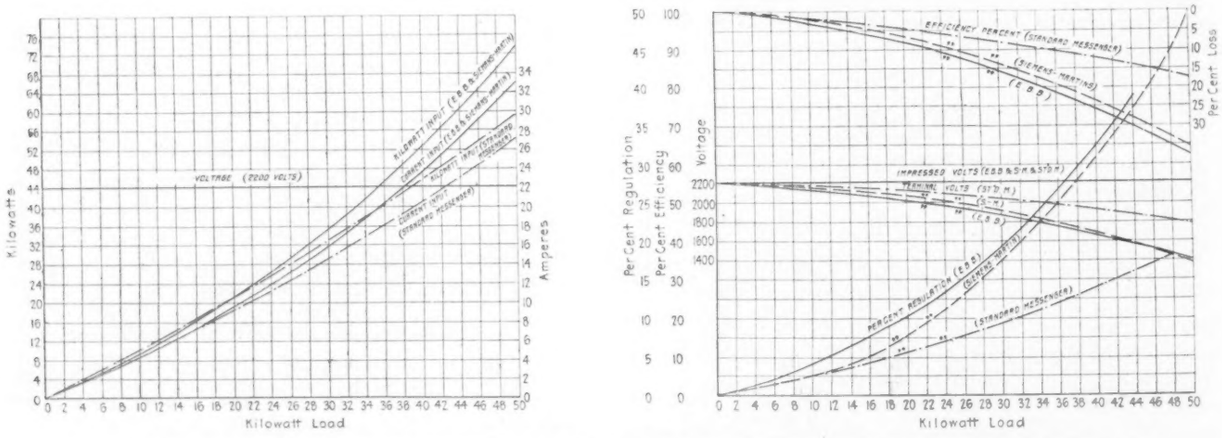
Mechanical tests were also conducted on several samples of each wire to determine their elastic limits and coefficients of expansion. The results shown in the tables were obtained.

The effective resistance for a mile of wire or the resistance to 60-cycle alternating current is not constant, owing to skin effect and magnetic properties of the iron. It increases rapidly until saturation is approached, when it becomes almost constant. The Siemens-Martin cable did not show saturation effects. Its resistance increases less rapidly with current than that of any of the other wires tested and is higher than that of E. B. B. cable for currents less than 15 amp., but less for currents greater than 15 amp. The permeability also has a marked effect on the reactance, that of Siemens-Martin cable being much less than that of E. B. B. cable of the same size.

RESULTS OF MECHANICAL TESTS ON THREE KINDS OF WIRE

Kind of Cable	Elastic Limit (Lb.)	Elongation Up to Elastic Limit for 8-In. Section	Elongation per Deg. Fahr. (In.)
¼-in. E. B. B. cable.....	1050	0.016	0.00000736
¼-in. Siemens-Martin steel..	2600	0.028	0.00000632
5/16-in. standard messenger	3250	0.026	0.0000073

For the range of load considered (0 amp. to 50 amp. at 2200 volts) there was very little difference in the efficiency of transmission with E. B. B. and Siemens-Martin cables, the losses being more than 35 per cent at 33 amp., corresponding to 50 kw. At the same load the regulation is 50 per cent, indicating the prohibitive losses and poor regulation of iron wire when used at high-current density.



FIGS. 1 AND 2—ELECTRICAL CHARACTERISTICS OF THREE 1-MILE IRON-WIRE EXPERIMENTAL TRANSMISSION LINES

From the mechanical tests made it is concluded that the great strength of iron wire compared with copper enables the use of longer spans and hence reduces the number of poles and towers required. Therefore the interest on the investment saved may partly or wholly offset the inefficiency of transmission of iron wire. Siemens-Martin wire has the lowest coefficient of expansion and the greatest strength. Its resistance and

*Data on solid iron wire, Bureau of Standards Scientific Paper No. 252, and by H. B. Dwight, *Proceedings* A. I. E. E., 1916.

reactance increase less rapidly with the current than for any of the other wires, and with heavy current the resistance, reactance and impedance are individually less than the same values for other types of iron wire of the same size. At low current values Siemens-Martin

COMPARATIVE RESISTANCES OF IRON AND COPPER WIRE AT 2200 VOLTS

Current	Copper	E. B. B.	Siemens-Martin
0	1.172	7.75	9.25
5	1.172	8.12	9.35
10	1.172	8.85	9.60
15	1.172	9.96	9.96
20	1.172	11.45	10.45
25	1.172	13.40	11.10

wire has higher impedance than resistance. On account of the effect of iron or steel on the electrical characteristic of alloys it is doubtful whether better transmission results can be obtained from the latter than with the

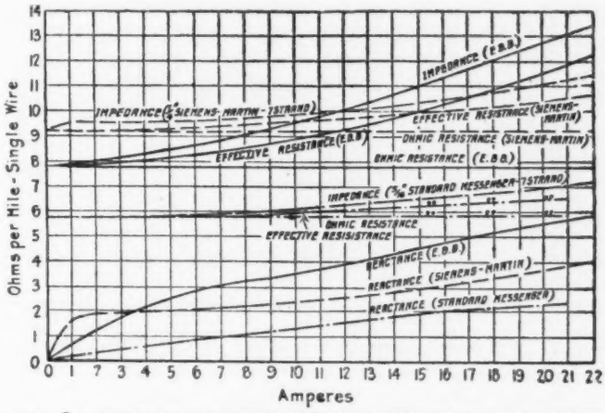


FIG. 3—IMPEDANCE, RESISTANCE AND REACTANCE OF THREE GRADES OF IRON WIRE

plain iron or steel wire. Conditions as to cost of copper, power to be transmitted, voltage, etc., will determine the advisability of using iron instead of copper wire, and also determine the type of iron wire which should be used.

Generators, Motors and Transformers

Theory of Armature Windings.—S. P. SMITH.—Part of a paper presented before the British Institution of Electrical Engineers. Rules for connecting closed windings and conditions for obtaining symmetrical lap and wave windings are taken up in this section.—London *Electrician*, June 1, 1917.

The Compounding of Alternators.—M. LATOUR.—The compounding of alternators is often obtained by means of automatic regulators which act upon the excitation circuit of the alternator. There are, however, systems of direct compounding which have given excellent results. The author describes the different methods which have been employed up to the present, giving particular attention to the method of compounding by the operation of shunt and series transformers, of which he is the inventor.—*Revue Gén. de l'Elec.*, June 16, 1917.

Lamps and Lighting

Incandescent Lamps.—A. BOUTARIC.—Second part of an article of which the first part, published June 2, dealt with the laws of radiation, values of light flux, etc., found to be yielded by luminous sources. In this part the principles of manufacture of various types of incandescent lamps are summarized, consideration being given successively to carbon filaments, metallic filaments, the Nernst filament, and the gas-filled bulb.—*Revue Gén. de l'Elec.*, June 16, 1917.

Generation, Transmission and Distribution

Resistance of Earth Connections.—L. BIRKS and E. WEBB.—Results of measurements made on the transmission line supplying Christchurch, New Zealand. From the tests made it appears that once a pipe reaches a depth of 6 ft. to 7 ft. (1.8 m. to 2.1 m.) increase in depth has little effect on the resistance of the earth connection. Considering the exceedingly high resistance of both dry soil and pure water, the conductivity in the immediate neighborhood of earth connections must be attributed solely to salts, alkalies or acids in solution. From tests made of the resistance of 70-ft. and 80-ft. (21.3-m. and 24.4-m.) artesian wells it was found that their conductivity is of the same order as that of a pipe driven 6 ft. (1.8 m.) deep in the same district. It therefore appears that the depth and area of the pipe in contact with the earth affects the resistance only to a limited extent. From a cursory examination of the result obtained it is concluded that single-pipe earths, no matter how well salted, will not give the value of resistance desired. Connecting a group of pipes in parallel will help, however, it being desirable to drive the pipe 6 ft. to 12 ft. (1.8 m. to 3.6 m.) apart to secure the best results. The tests indicated that better results can be obtained with a bare pipe driven in the ground than with a pipe packed in coke, provided that the former is perforated and filled with salt and water. For salting the pipe it was considered best to use coarse salt for the initial charge and rock salt for the final one, as the latter takes considerable time to dissolve.—London *Electrician*, June 1, 1917.

Installations, Systems and Appliances

Electricity Supply at Keighley, England.—HARRY WEBBER.—Features of the construction and operation of a new generating station of the Keighley electricity works are described in this paper. Data on the amount charged for energy supplied to various industrial concerns served from this central station are given.—London *Electrical Review*, June 15, 1917.

Plowing Electrically.—Editorial suggesting that plows be operated through the means of flexible cables and temporary transmission lines to speed the work of plowing.—London *Electrical Review*, June 15, 1917.

Burning Anthracite Coal.—W. H. BOOTH.—Problems involved in burning anthracite coal and methods of solving them.—London *Electrical Review*, June 15, 1917.

Fuel Economy.—Editorial pointing out that the way to save coal is to use more electrical energy. In the body of the paper suggestions were given as to a possible substitute for the grades of fuel ordinarily employed in generating plants.—London *Electrical Times*, June 14, 1917.

Units, Measurements and Instruments

Average Eye for Heterochromatic Photometry.—E. C. CRITTENDEN and F. K. RICHTMYER.—This paper records the results of investigations made to approximate the average normal eye in measuring light intensities where color differences are involved. In particular results obtained by flicker photometer and by an equal-

ity-of-brightness photometer, with different degrees of color differences, are compared. In terms of the Ives-Kingsbury test solutions, for which the proposed normal ratio of transmissions (with a 4-w.p.c. carbon lamp) is 1.00, the average of 114 observers gives a ratio of 0.99. By using these test solutions results obtained on the flicker photometer by a small number of observers can be corrected so as to give normal values with a high degree of accuracy. On the average, equality-of-brightness measurements also vary in proportion to the test ratio, but erratic variations often overshadow these systematic differences. For sources having relatively high intensity in the blue, flicker values tend to fall below those obtained on the usual standard photometers, but the difference is comparable in magnitude with the uncertainty of the latter values.—*Bureau of Standards, Scientific Paper No.* 299.

Self-Recording Electrometer.—W. A. DOUGLAS RUDGE.—Description of a simple and inexpensive self-recording electrometer for measuring atmospheric electricity.—London *Electrician*, June 1, 1917.

Measuring Insulation Resistance on a Large Distribution System.—G. W. STUBBINGS.—A method of measuring the insulation resistance of a large three-wire network is described. It is based on the alteration of the neutral potential and the creation or removal of an artificial fault. The current in the earth connection is measured with the resistance short-circuited and again with the circuit breaker or fuse open. Calling these currents I' and I respectively, and the potential of the neutral with the circuit breaker open E, the insulation resistance of the network is ascertained by the formula $R = E \div (I' - I)$. If the conditions are such that readings of the earth ammeters are very small with the circuit breaker closed, an artificial fault of known resistance can be inserted in one of the outer legs to increase the reading. The insulation resistance as calculated will include this resistance. In order to obtain accurate values of the separate insulation resistances of the three mains, the voltage across each side of the system may be altered. First the voltage on the positive side can be raised, then that of the negative side, the voltage across the outer legs meanwhile being maintained constant. The alteration in the potential of the neutral from earth with a moderately high resistance in the earth's circuit is obtained, and from the observed data the insulation resistance of the three mains can be calculated. It is not necessary to open the circuit breaker in the earth connection if means are employed for determining with fair accuracy the alteration in the current in the earth connection. If conditions are such that the current in the earth connection is very small, artificial leaks can be introduced to give good reading. This test will, of course, fail if the fault on the neutral is so great as to cause current to circulate between it and the neutral busbar. Details of making the last two tests are given in the paper.—London *Electrical Review*, June 8, 1917.

Miscellaneous

Induction Apparatus for Locating Projectiles in Human Bodies.—ST. PROCOPIU.—An article describing a device for discovering foreign substances of a magnetic nature in the bodies of the wounded which differs both from the electrovibrator and the electromagnetic balance. With the electromagnet the projectile is discovered by the touch, and with the induction balance by means of the telephone. The apparatus here described utilizes a galvanometer to detect the presence of a bullet or other magnetic substance, and makes it possible to discover the depth to which it has penetrated. The chief distinguishing characteristic of the apparatus is the employment of a galena detector to rectify the induced currents.—*Revue Gén. de l'Elec.*, June 9, 1917.

Electric Cooking Apparatus.—(Abstract of first report of commission on heating and cooking apparatus.) The practical requirements of electric cooking apparatus, electrical insulation thereof, connections between heating elements and terminals, accessories, efficiency of electric cooking and various practical points in the design of cooking appliances are subjects discussed in this paper.—London *Electrician*, June 8, 1917.

Derivation of the General Equation for Wave Motion in an Elastic Medium.—J. A. FLEMING.—The paper explains a simple method of arriving at the general differential equation for wave motion; viz.,

$$\frac{d^2\varphi}{dt^2} = c^2\left(\frac{d^2\varphi}{dx^2} + \frac{d^2\varphi}{dy^2} + \frac{d^2\varphi}{dz^2}\right),$$

where c is the velocity of propagation of the wave. A wave motion consists in the propagation of some form of strain through an elastic-dense medium or one having comparable qualities. Corresponding to this strain there is an analogous stress in the medium, and we can express this stress mathematically in two ways—viz., kinetically, as the product of the density and the time rate of change of the strain, or by $m\frac{d^2\varphi}{dt^2}$ per unit of volume, and also statically as the space increment of the expression $e\frac{d\varphi}{dr}$, where e is a coefficient of elasticity and r is a vector denoting direction of propagation. Hence, for plain waves we can write the equation

$$\frac{d^2\varphi}{dt^2}\delta r = \frac{d}{dr}\left(e\frac{d\varphi}{dr}\right)\delta r,$$

or if m and e are independent of distance, we have

$$\frac{d^2\varphi}{dt^2} = \frac{e}{m}\frac{d^2\varphi}{dr^2},$$

which is the known differential equation of wave motion for plane waves. Its solution is $\varphi = F\left(x \mp \sqrt{\frac{e}{m}}t\right)$, where F is some function. In the same manner for spherical waves originating in a point source we can write the stress equation

$$4\pi r^2 m\delta r\frac{d^2\varphi}{dt^2} = \frac{d}{dr}\left(4\pi r^2 e\frac{d\varphi}{dr}\right)\delta r,$$

which at once gives

$$\frac{d^2\varphi}{dt^2} = \frac{e}{m}\left(\frac{d^2\varphi}{dr^2} + \frac{2}{r}\frac{d\varphi}{dr}\right);$$

or if $r^2 = x^2 + y^2 + z^2$, we have

$$\frac{d^2\varphi}{dt^2} = \frac{e}{m}\left(\frac{d^2\varphi}{dx^2} + \frac{d^2}{dy^2} + \frac{d^2}{dz^2}\right).$$

The solution of this last equation is

$$\varphi = \frac{1}{r}F\left(x \mp \sqrt{\frac{e}{m}}t\right),$$

where F is some function. The general equation for electromagnetic-wave propagation in a pure dielectric may also be obtained in the same manner.—Abstracted from paper presented before Imperial College of Science in London *Electrician*, May 25, 1917.

NEWS OF THE INDUSTRY

Chronicle of Important Events and General Activities in the Technical, Commercial and Manufacturing Fields

COAL PRODUCTION COMMITTEE IS BESIEGED FOR RELIEF

Telegrams Pour in Daily Telling of Difficulties in Obtaining Fuel—Some Relief Afforded Central Stations in New England Territory

The committee on coal production and distribution of the Advisory Commission of the Council of National Defense is receiving between fifty and a hundred telegrams a day asking for assistance in obtaining coal, according to a statement made to a Washington correspondent of the ELECTRICAL WORLD by F. S. Peabody, chairman of the committee.

"Notwithstanding the fact that we have no powers in law," said Mr. Peabody, "such as are proposed in the so-called food bill now pending in the Senate, we are doing the best we can to be of service to the industries. In this work the electrical industries are receiving their full share of attention, and Mr. Elliott and Mr. Storrs, representing respectively the electric light and power industries and the street railway industries, are reporting to me that everything that can be done is being done. Our system is, upon receipt of these telegrams, to find sellers who have coal and place those who want it in touch with the sellers. This is working out successfully."

Mr. Peabody said he was not able to state which companies in the electric industries have been so helped. There has been no geographical limitation, he said. All are being treated alike. It was admitted in Washington, however, that the committee was able to afford some measure of relief to the utilities in New England.

Asked whether his committee intends to urge Congress to pass the coal provisions in the so-called food bill, Mr. Peabody said that is unlikely. The committee feels a certain diffidence, it is understood, in going before Congress, because it has no official standing.

WHAT THE INDUSTRY FACES BECAUSE OF WAR

Some of the Problems Imposed, and How the Public Utilities Will Meet Them—Conservation of Fuel and Investment Necessary

How the electrical industry may assist the government to bring the war to a successful issue was the subject of an address given by John W. Lieb, president of the National Electric Light Association, before the New York Jovian League on July 11. The industry, he said, is alternately optimistic and pessimistic. Some of its difficulties will be corrected through the intervention of the national government, but the labor problem will not be among them. Not the least of the problems will be managerial, for all companies will find it increasingly difficult to secure the necessary capital for expansion and imperative extensions. The present war is one involving primarily engineers, materials and supplies. Ingenuity is being taxed and brain matches brain. The electrical industry will be called upon to play a major part. As for central station companies, they are doubly patriotic. They send many of their men to the colors, and with the rest maintain unimpaired service so that industry may become more productive and the army and navy lack nothing. Abroad the whole aim now is to stimulate the electrical industry, so as to conserve the supply of fuel. Public utilities in this country will co-operate for the same purpose, and, besides, interconnect their systems to obtain maximum use of equipment.

HEARING SET FOR RATE INCREASE IN INDIANA

Commission to Hold a Three-Day Public Hearing at Indianapolis on Petition of Indiana Electric Light Association for Surcharge

The Public Service Commission of Indiana has set aside July 23, 24 and 25 for the hearing on the petition of the Indiana Electric Light Association for a 30 per cent surcharge on each bill rendered for electric service. Thirty-six companies, whose services cover most of the State, join in this petition. The decision may govern the attitude of other companies also. The hearing will be held at the State House, Indianapolis, and will be open to all.

Summarized, the petitioners allege:

1. That the rates now in effect are based on the average of normal or prevailing prices of coal, labor, material and taxes.

2. That during the past year the petitioning utilities have been compelled to bear an extraordinary and unprecedented increase in these costs and of all other elements entering into cost production and distribution.

3. That the utilities are unable to contract for future deliveries of coal except at a very great advance over the normal prices, and believe it will not be possible during the continuance of the war to purchase either coal supplies, materials or labor except at prices far in excess of normal.

4. That the average percentages of increase of prevailing prices over normal prices are: Coal, 194; labor, 32.67; copper, 144.86; miscellaneous supplies, 65.91; taxes, 48.41; equipment, 51.14; general operating, 45.50.

5. That for some months utilities have suffered financial losses; that such losses will result in the curtailment of present service, inability to finance necessary extensions and additions, and in insolvency of many utilities if temporary relief is not given immediately.

The petitioners allege that the demands of the government for material and products will result in requiring extensions, improvements and additions to existing plants and more intensive operation, and that the credit of such public utilities should be maintained to finance these demands. The petitioners allege that in England such steps were taken after the beginning of the war and that the surcharge has been increased to 50 per cent.

ARMY CANTONMENT WORK SHOWS RAPID PROGRESS

In Many Instances the Electrical Distribution Lines Are Installed Long Before the Structures Are Finished

Several of the army cantonments have been completed. The first to be ready was that at Fort Douglas, Utah, that being the first contract let. This contract was let May 12, and the contractors, James Stewart & Company, turned it over to the government on June 26. Contractors who are building these cantonments, who have offices in Washington, are highly pleased with the co-operation afforded them by the government. Since the Fort Douglas cantonment was begun there has been established the emergency construction committee of the Munitions Board of the Council of National Defense, which is working with committees on lumber, cement, electrical materials, etc., composed of experts in these various business lines. These committees inform the office of Colonel Littell, who is in charge of the construction of the cantonments, as to where materials are to be found and the prices it is recommended that the contractors should pay for them.

Allotment schedules, specifying materials, sizes, quantities, prices, etc., are then sent by Colonel Littell's office to the constructing quartermaster of the army at each cantonment under construction. These schedules not only contain the names of firms and companies from which the materials should be purchased but quote the prices which should be paid. If the contractors can beat the prices to be paid, it is up to them to do so. If the question of delivery is more important than the question of price, then the question of delivery controls. The constructing quartermaster at each cantonment decides the point when it is submitted to him by the contractor.

Cost Plus Percentage Basis Not Followed

There is no opportunity for "profiteering" in this work. There is no allowance for administrative expense. Not a cent is allowed for overhead charges, such as work done at main offices or branch offices. When information in regard to the building of the cantonments was first allowed to become public it was stated that a system of cost plus 10 per cent payment would probably be adopted by the government. That has not been done. A sliding scale of payment has been adopted under which the profit on the largest cantonment shall not be more than $250,000. If the largest cantonment to be built—that at American Lake, Wash.—for instance, which will house 40,000 men, costs $6,000,000, there will be a profit in it when the bills are audited of only about 4 per cent. The maximum profit is said to be about 6 per cent. The smaller cantonments, such as that at Fort Douglas, which will house 9000 men, will cost, it is expected, when the bills are finally audited about $500,000.

The plans for the cantonments are based upon a unit system. To increase the size or to decrease the size of a cantonment merely means adding to or lessening the number of units. The cheapest electrical construction, as to wiring, etc., conformable to safety from fire is being used. In every case sites have been selected so that the cantonments may be connected with local power plants as well as water. In most cases sewers have been especially built.

ARMY CANTONMENT AT FORT DOUGLAS, UTAH, ELECTRIC SERVICE TO WHICH ANTEDATED ITS ERECTION

Little Rock Central Station Gets Contract

The Little Rock (Ark.) Railway & Electric Company has closed a contract with the War Department to furnish a 1000-kw. demand for electric light and power at the Twelfth Divisional Cantonment, which is near Little Rock. Several miles of transmission lines will be run, besides a large amount of 2300-volt distribution, all of which are to be in service by Sept. 1. The con-

THE FORT DOUGLAS CANTONMENT WAS ERECTED BY THE AID OF ELECTRICITY

tract was closed in Washington on Saturday, July 7, by C. J. Griffith, general manager of the Little Rock Railway & Electric Company, and E. T. Selig, commercial engineer of the United Gas & Electric Engineering Corporation.

PROBLEM OF ENERGY SUPPLY UNDER CONDITIONS OF WAR

Director George Otis Smith of the Geological Survey Asks Public Service Commissions to Co-operate in Power Study

Director George Otis Smith of the Geological Survey has written to state public service commissions in regard to the problems pertaining to the supply of energy under war conditions. He says that a few of the problems which must be given careful consideration either at once or later are:

1. The furnishing of an adequate fuel supply to existing plants.
2. An increase in the output of hydroelectric energy to conserve fuels for other uses.
3. A proper correlation of new industries with existing power supplies.
4. The extension of existing power systems and an increase of power output to supply new industries.
5. The interconnection of power stations to improve load factors.

The Geological Survey, through its Division of Mineral Resources, has for many years been studying the fuel supplies of the country. Its water resources branch has been similarly engaged in the investigation of water power. The land classification board has been charged with the administration of water-power sites on public lands and has thus become familiar with the public utility viewpoint. I am confident, therefore, that through previous experience and accumulated data this organization is well qualified to act as a national clearing house on power questions. The Secretary of the Interior has authorized the survey to co-operate with public utility commissions, and I believe that work of this character cannot be undertaken too soon.

NO TAX ON ELECTRICITY IN SENATE MEASURE

Substitute for Food Bill Provides Sufficient Revenue Without Including Added Burdens on Users of Central Station Service

Senator Simmons, chairman of the Senate finance committee, has informed the Washington correspondent of the ELECTRICAL WORLD that he is informed that the proposed substitute for the so-called food bill which is to be introduced into the Senate by the committee on agriculture will dispose of the distilled-spirits question in such a manner as will make unnecessary the recasting of the war tax bill. It has been believed that if the government lost a large amount of taxes on distilled spirits it would be necessary to recast the war tax bill so as to include taxes on the electrical industries other than telephone and telegraph.

There is authority among the members of the Senate finance committee, in view of what Senator Simmons is quoted above as saying, for the statement that taxes on electrical energy, etc., will not be added to the war tax bill so far as the Senate tax committee is concerned.

The Senate has tentatively agreed to vote on the food bill on July 21. This permits the tax bill to come up in the Senate on July 23, and Senator Simmons estimates that one month's time will be required between the day the Senate gets the bill and the day the President receives it. In other words, there will be a long debate on the bill, and the question of what the House of Representatives will endeavor to do in regard to restoring the taxes on electricity which the Senate committee has stricken out remains at this writing an open question. The Senate bill will be reported retaining proposed taxes on telephone and telegraph messages.

FLOODLIGHTING FOR THE BALTIMORE COMPANY

Lexington Building, New Home of Consolidated Gas, Electric Light & Power Company, Made Beautiful by Night

Flooded with light, the Lexington Building, the new home of the Consolidated Gas, Electric Light & Power Company of Baltimore, is as beautiful by night as it is by day. The illustration is a reproduction of a photograph, not retouched.

NEW HOME OF CONSOLIDATED GAS, ELECTRIC LIGHT & POWER COMPANY

Lighting of the northern and western façades is accomplished by eighty-six 250-watt concentrated-filament gas-filled lamps, which are placed in three batteries of floodlighting projectors on the roof of the old building, northwest corner of Lexington and Liberty Streets. Each reflector was separately adjusted in order that the lighting might be uniform. Approximately twice as much light is thrown on the upper floors of the building as on the lower floors.

Later the southern and eastern façades were similarly lighted, making the structure a beacon of progress visible from all points of Baltimore as well as from all approaches to the city.

INQUIRY ON ELECTRIC RATES BY CITY OF DAYTON, OHIO

William J. Hagenah, Who Is Making an Investigation on Behalf of the Municipality, Tells Status of Work

Replying to a letter from the ELECTRICAL WORLD, William J. Hagenah of Hagenah & Erickson, Chicago, writes in regard to the situation at Dayton, Ohio, which he has been engaged to investigate:

"I have your letter requesting a statement regarding the status of the work which I am doing for the city of Dayton in the matter of its electric rate controversy with the Dayton Power & Light Company. It might be better for you to communicate on this subject with H. M. Waite, city manager of Dayton, under whose direction the investigation is being made. He could give you more authoritative information than I can.

"The investigation which the city of Dayton is making of the Dayton Power & Light Company is occasioned by the expiration of the term for which the present schedule of rates was adopted. Subject to the usual right of appeal in such matters, the city of Dayton possesses the authority to prescribe rates to be charged for electric service in that city. While there may be some question as to the extent of that authority, there is no question about the city's right to fix the legal maximum rate.

"On the expiration of the rate period referred to, the company submitted a new schedule of lighting rates which was a considerable improvement over the existing rates and also offered some reduction. The city, however, did not accept this schedule, but asked the company for the privilege of making such an investigation and preparing such data from the company's records as were deemed necessary in order to enable the city's officials to pass on the issues intelligently and with due regard for the interests of the public.

"For the purpose of making such investigation and compiling the data desired, the city of Dayton engaged my services last year, and certified public accountants in my employ have made an analysis of the company's financial operating records for the last three years. A study has also been made of the operating statistics, such as the number of customers, connected load, load factor, kilowatt-hour output, and the sales to the different classes of customers, and other data required in an investigation seeking the net earnings of the company, the approximate investment in operating plant and the range of cost of service.

"This work has been carried on from time to time since last autumn, there having been postponements in the work in order to observe the effect on the operating expenses of the recent large increase in commodity prices and the price of labor in many industries. The company has co-operated in the examination of its books and records for the above period and has extended to the city every courtesy and facility.

"The situation has been somewhat complicated recently by the company's filing with the Ohio Public Utilities Commission an amendment to its present schedule seeking an increase in the rates in a number of classes of service. Against the granting of this increase the city has protested. The action of the company came as a surprise, since the city had been entertaining the belief, which appeared to be sustained by the facts disclosed in such parts of the investigation as had been completed to date, that the company was extremely prosperous and that the lighting customers of the city might with good reason expect a substantial reduction in the existing schedule.

"Of course, I am not determining the policy of the city in this matter, and therefore cannot speak officially as to the probable steps which will be taken. Especially is this matter still in doubt since the investigation work contemplated at the outset has not all been concluded. I feel safe in assuming, however, that the city will not take any action, except to protect its rights, until it feels that it is fully conversant with the facts involved in the making of the rates in question and the bases on which the new schedule should be founded. The entire subject matter is now being carefully analyzed, to the end that strong and convincing data may be presented to sustain whatever course of action the city finally decides to adopt."

COST OF GETTING BUSINESS REJECTED FOR CINCINNATI

Ohio Supreme Court Approves Public Utilities Commission Order with Exception of $375,000 for Attaching New Business

Through a decision on July 3, the Ohio Supreme Court has approved the order of the Public Utilities Commission fixing the value of electrical properties of the Union Gas & Electric Company of Cincinnati for rate-making purposes, with the exception of the amount in the capitalization claimed for attaching new business. This item was $375,000 and was fixed by the commission engineer. The court said:

"The placing of a value upon such an item to be included in the permanent capitalization of a company, which is to be used for the purpose of fixing rates to be paid by the public during long periods of time, is necessarily uncertain, theoretical and somewhat arbitrary. The engineer of the commission himself testified that the amount fixed was his estimate of what it probably would cost to secure a given number of customers.

"It is apparent that such customers would have to be secured under varying circumstances, which, when estimated in advance, would be purely hypothetical. The burden of the proof was upon the companies to establish this item by direct evidence. We think this was not done in this case, and the order of the commission in so far as that item is concerned is disapproved."

The total value of the property as fixed by the commission is $8,945,125.

CALL FOR MEETING OF THE OHIO ASSOCIATION

Gathering at Columbus on July 19—Round Tables on Association Work and Central Station Operation for 1917-18

Active members of the Ohio Electric Light Association are to meet in the Hotel Deshler, Columbus, on July 19. The meeting takes the place of the annual convention, which was to have been held at Cedar Point during the same week, but was abandoned on account of war conditions.

The morning session on July 19 will be devoted to a

round table on association work, including oral reports and suggestions from chairmen of standing committees and a report of the nominating committee.

In the afternoon there will be a round table on central station operation for 1917-18 and the election of officers.

TESTS OF FAHY PERMEAMETER BY THE BUREAU OF STANDARDS

Experimental Tests to Determine Precision and Find to What Extent Various Factors May Affect Accuracy

The Fahy permeameter for magnetic testing was fully described in the ELECTRICAL WORLD of Feb. 17, 1917. The Bureau of Standards has carried out experimental tests to determine the accuracy of this instrument under various conditions of use. This work was done by C. W. Burrows and R. L. Sanford, and will be published complete in Scientific Paper No. 306.

This study of the permeameter was made with the view of determining its precision and of finding to what extent various factors might affect its accuracy. The following factors were examined in the course of the work:

(1) Consistency on repetition.
(2) Length of specimen.
(3) Projection of specimen beyond the test coil pole face.
(4) Reluctance of joints.
(5) Effect of iron in the neighborhood.
(6) Position of specimen on pole face.
(7) Absolute accuracy.
(8) Use uncompensated.

The ability of this apparatus to repeat readings on the specimen under the same conditions is all that could be desired. The consistency is so good that the apparatus may be used to detect small changes in magnetic characteristics due to aging, mechanical strains or variations in heat treatment.

This apparatus is designed to take specimens 10 in. (25.4 cm.) long, but it happens frequently that it is necessary to test specimens of other lengths. Tests carried out with greater lengths of specimens showed very little effect due to length. This is true provided the specimen does not project beyond the test-coil pole face, but if specimens are very much shorter than the prescribed length an inaccuracy is introduced. It is not necessary that the specimen be lined up accurately, and no trouble is to be expected from inaccurate adjustment in the position of the test piece.

It is to be expected that in an apparatus of this type reluctance of the surface of contact will affect the accuracy. This was tested by placing sheets of paper between the specimen and the pole face. The greatest effect was found for values in the region of maximum permeability. The test showed that when the specimen alone is in place the reluctance of the joint does not give rise to any serious source of error. For precision work, however, it is desirable to have a good magnetic contact at the pole face.

Pieces of iron in the neighborhood of the apparatus do not produce any appreciable effect unless they are very close. If actually in contact with the test-coil pole face they will cause appreciable error.

Identical results were found for all positions of the test specimen on the pole face. It was shown that symmetrical location was not essential.

The absolute accuracy of measurements taken by this permeameter was determined by the comparison of the same specimen in the Burrows form of apparatus. Carefully prepared standard rods were used for this purpose. In every case the measurement agreed within 5 per cent, which is sufficient accuracy for most commercial tests. In fact, this agreement is more than is necessary in testing many materials, because the inhomogeneity of commercial material is usually greater than this. Thus the permeability of transformer steel may differ from part to part of a single sheet by as much as 10 to 20 per cent.

Measurements taken without first properly compensating the apparatus showed that the error thereby introduced is not greater than the error existing in several types of permeameters now in use; consequently the Fahy permeameter may be used without compensation for many kinds of shop testing where only comparative results are desired. In materials of the same grade the characteristics would be nearly identical and relative results would be the same. The advantage in omitting the compensation lies in the greater speed of operation.

These tests have determined that the Fahy permeameter represents a distinct advance in apparatus for the measurement of magnetic qualities. It excels in accuracy the direct-reading permeameters which are generally available, for consistent results can be obtained to a good degree of accuracy. Hysteresis measurements are accurate within the limits of commercial requirements and the uniformity of commercial materials.

COMPETITION FOSTERED BY SAVANNAH DECISION

Georgia Railroad Commission Holds that Framers of Constitution Were Distrustful of Even Regulated Monopoly

A decision in the Savannah rate case has been rendered by the Georgia Railroad Commission. It says that the constitutional provisions had in mind the encouragement and fostering of competition in its fullest sense, and "expressly forbade the Legislature from authorizing any transaction between corporations that would defeat or lessen competition. The anticipated benefits of competition could only be reflected in rates and service. Having safeguarded the public against unreasonable and unjustly high rates, the framers of the constitution evidently had in mind securing for the public the lowest rates and the best service that competition might bring about. The constitutional framers were evidently distrustful of even regulated monopoly.

"There is, in our opinion, nothing in our laws which prohibits a public utility from giving the public the benefit of a lower rate than may be prescribed by the commission, should it appear to the interest of the corporation in the existence of a sound business policy so to do, provided, of course, it does not unlawfully discriminate in so doing.

"We are of the opinion that our public policy, as evidenced by the constitution and statutes of the State and as uniformly followed by the courts and the com-

mission, has been to encourage corporations so to favor the public.

"The commission will therefore provide in its order that if the utility charges any class of patrons a lesser rate than the maximum prescribed by the commission for that class, a like percentage of reduction shall be given all other classes."

The commission orders that "the giving or contracting for flat rates or any other than meter rates shall be wholly discontinued."

The Savannah Lighting Company contended that the commission should make actual rates, from which there should be no deviation to a lower level or from which there should be no deviation except by permission of the commission. The Savannah Electric Company opposed a minimum rate, contending that the commission had authority to establish only maximum rates.

TIDE WATER POWER COMPANY ANNOUNCES RATE INCREASES

New Rates as Reasonable as Are Consistent with Maintenance of the Property and Service to the Public

The Tide Water Power Company, Wilmington, N. C., has announced that on account of the great increase in price of coal, gas, oil and other supplies of all kinds it has become necessary to increase rates for electric light and power and for gas. Increased schedules were filed with the Corporation Commission before public announcement was made and there has been no appeal to that body.

The notice addressed by the company to consumers, which has been received by the ELECTRICAL WORLD from A. B. Skelding, general manager, says in part:

It seems advisable to make a general statement that conditions, due directly and indirectly to the war, will make it necessary to economize in every department. To accomplish this end it will be essential from time to time to make changes in schedules, methods and amount of service.

The increased cost of all materials and supplies, especially the increase in the cost of coal (for fuel and for the manufacture of gas) and of the crude oil used, will make necessary certain increases in rates.

The policy of the company will be to make new rates which are as reasonable as consistent with due regard to the maintenance of the property, and to giving to the public the service that can be expected under the conditions prevailing.

It has been the policy of the company during the past fourteen years to reduce rates and improve service wherever possible. This policy would have been continued were it not for the present conditions which are affecting adversely the whole civilized world.

PROVIDENCE CENTRAL STATION RATE INCREASE IS FORECAST

President Barrows Points Out That Rising Costs Due to War and Other Causes Make Action Necessary

Forecasting application to the Rhode Island Public Utilities Commission for authority to increase lighting rates, a formal notification was addressed recently by the Narragansett Electric Lighting Company to Mayor Gainer of Providence that the company's exclusive franchise would be allowed to lapse.

President Barrows pointed out that rising costs due to the war and other causes have made it necessary for the company to make provision for increasing prices. Under the franchise terms the company was restricted as to rate increases with the exception of house and small retail lighting. In addition to clearing the way for rate advances, cancellation of the franchise tax of the company, amounting to one-half of 1 per cent of the gross earnings, follows the lapsing of the franchise. This totals about $7,000 per year at present.

President Barrows reviewed numerous rate reductions by the company in the past five years, which of late have been based upon a coal cost of $3.85 per ton and copper at about half its present cost. Cost of coal has increased from an average of about $3.85 per ton, including transportation charges, to an average for about 47,000 tons during January to May, 1917, inclusive, of $8.87 per ton. Other costs, including materials and labor, have risen, and if these continue or increase, higher prices for electric light and power are quite inevitable.

The company anticipates that it may be necessary for it to proceed toward a rate increase within the next six months.

ST. LOUIS COMPANY OCCUPIES NEW BUILDING

General Offices of Union Electric Light & Power Company All Housed in One Eleven-Story Structure

The new building of the Union Electric Light & Power Company, St. Louis, has been completed, and the general offices and electrical merchandising store have been moved into it. The building, eleven stories high, 149

NEW OFFICE OF UNION ELECTRIC LIGHT & POWER COMPANY, ST. LOUIS, MO.

ft. by 100 ft. (45.41 m. by 30.48 m.), and having 7400 sq ft. (700 sq. m.) of floor surface, is at the corner of Locust and Twelfth Streets. Practically all of the space on the first floor fronting the streets is given over to the merchandising, sales and application departments.

FALL RIVER TRANSMISSION TIE-LINE PROJECT APPROVED

Company Wins on Ground of Economic Necessity and Advantage of Interconnection as General Policy and War Measure

Permission to construct a 66,000-volt two-circuit transmission line from Fall River to Seekonk has been granted the Fall River Electric Light Company by the Massachusetts Gas and Electric Light Commission. Considerable opposition developed on the ground that the proposed line would cut down taxes otherwise resulting from steam plant enlargement in Fall River.

The decision points out that the Fall River company will have a capacity of 16,000 kw. in operation within a few weeks; that the present station building will then be fully occupied, and that the proposed line will have a capacity of about 20,000 kw., half of which will be contracted for at first. The line will tie the local system into the 56,000-kw. and 45,000-kw. systems of the New England Power Company and Narragansett Electric Lighting Company respectively.

The Fall River company's power load has doubled in the last year, and a maximum load of about 10,000 kw. is expected this fall, with further increases of business. The estimated cost of the line is $300,000, compared with more than $1,000,000 for a station addition of like capacity, and the line can be erected within a few months as against about two years for the station addition.

The commission says in part: "It is of the utmost importance to the welfare of Fall River that this company shall make prompt and adequate provision for the industrial power requirements of the city. The proposed line is an effective and the only practicable step to that end. . . . A full and skillful execution of this scheme offers not only possibilities for better operating efficiency and lower generating costs at large power stations but also substantial economy in permanent investments. High-tension transmission of electricity has given a wider aspect to the solution of the problem, and has made possible and desirable that the developed sources of power, both steam and hydroelectric, throughout the State shall be so co-ordinated by connecting lines as to result in utilizing all plants more uniformly and in the end in substantial economies of investment and operation.

"Moreover, it has brought to the aid of the industries of the State, and particularly by means of the lines of the New England Power system, water powers heretofore only partially developed and in the broad sense unused because inaccessible. A progress having so much promise of a real conservation of the natural resources, both of coal and water, and of their most efficient devotion to the production of power, is highly important to the welfare of the State and nation.

"It appeared at the hearing that the mills of Fall River use more than 100,000 hp., that additional power is needed for mills which the exceptional industrial activity of the present period is opening, and that many of the older mills are facing in the near future the necessity of renewing their power plants. The concentration of generating capacity in one plant, if properly planned, should work substantial economies in operating costs, release for industrial purposes capital which must otherwise be tied up in a number of separate power plants, and give the community as a whole in the end the benefit of lower unit costs and therefore lower prices for electricity.

"Such a development requires great prudence because so closely related to the prosperity of the one dominating industry of Fall River (textiles) and because its success depends on a great output of electricity, which, to hold the business, must be sold at a narrow margin of profit. One important and wise step in its accomplishment is to tie in this company's plant with a reliable and adequate source of power so that it may meet promptly, but without an undue expansion of its own station, all requirements of the community for energy. Such a policy wisely followed is in the opinion of the board consistent with the public interest. The proposed line, so essential in the present emergency, is equally essential to the public convenience.

"This conclusion is not affected by the fact that the relation of the Fall River company to the New England Power system will be through a foreign corporation, nor does it necessarily follow, as urged at the hearing, that the Fall River company will thereby come under the dominance of any other interest. Fall River is too well located for the economical production of steam-generated power to make it probable that it will ever become permanently dependent upon power generated elsewhere, save only in such amounts and at such prices as will be advantageous to its industries.

"It was stated at the hearing that it is the company's policy, apart from the erection of the line, to develop its station as fast as the growth of its business may demand and the condition of the market for labor and equipment may permit. Even were it possible to provide for the company's immediate needs by increasing the capacity of its present station, yet at some time this proposed line would be needed to assure the industries of Fall River reliable and low-priced service."

PROPOSED INDEX FOR THE NATIONAL SAFETY CODE

Bureau of Standards Issues Supplement with a Request for Examination and Constructive Criticism by Engineers and Administrators

Dr. S. W. Stratton, director of the Bureau of Standards, in requesting criticism of a proposed index of the National Electical Safety Code, writes:

"Users have suggested that an index should be prepared. The bureau recognizes this need for a subject index, and since the latest revisions of the code and its publication in November, 1916, such an index has been prepared with the aid of a number of outside engineers.

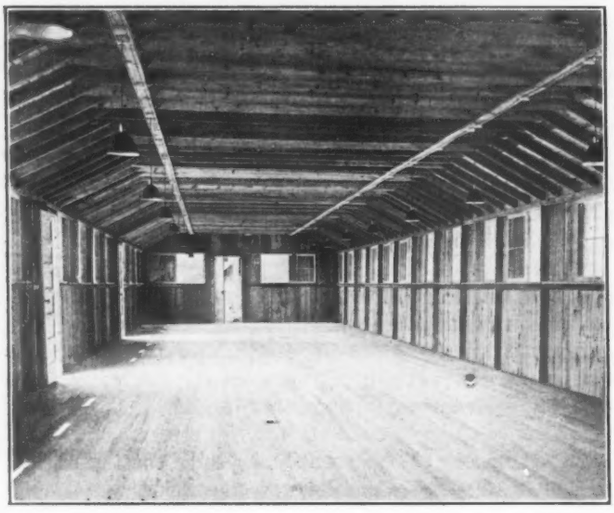
"We now take pleasure in submitting the index which is the result of this co-operative effort to those engineers best acquainted through their previous study with the code rules and to the administrators most concerned in the application of the code to practice. Their examination of this index is requested. Through their co-operation we hope to be able to repair deficiencies of importance, whether of omission or error. Such an index must, of course, be a compromise between completeness and reasonable brevity. The comments received will be compared and utilized in a revision which will be printed and distributed without unnecessary delay."

LOCATION OF NAVY AND MARINE CORPS CANTONMENTS

Electrical Equipment Is in All Cases Necessary and Service Will Be Obtained from Public Utility Companies

For certain reasons of their own, officials of the government at Washington are not willing to have published as many technical details of the construction of the navy cantonments, training stations and camps and the Marine Corps cantonments which are now being built for the navy as the army has allowed to become known in regard to its cantonments. Nevertheless, the representative at Washington of the ELECTRICAL WORLD has succeeded in obtaining for publication some of these details.

At Newport, R. I., there is being constructed a training station for 2000 men; at City Park, Brooklyn, a



INTERIOR OF MARINE CORPS BUILDING AT QUANTICO, VA.

barracks for the receiving ship to accommodate 3000 men; at Pelham Park, N. Y., a camp for 5000 men; at the Philadelphia Navy Yard a camp for 5000 men; at Cape May, N. J., a camp for 2000 men; on the Jamestown Exposition site in Virginia, which the government has recently acquired, a training station for 10,000 men; at the navy yard at Charleston, S. C., a camp for 5000 men; at Pensacola, Fla., quarters for 1000 aviators; at Key West, Fla., a camp for 1000 men; at the Great Lakes naval training station in Chicago, a training station for 17,000 men; at the Mare Island Navy Yard, California, a camp for 5000 men; at the Puget Sound Navy Yard, a camp for 5000 men. There are, besides, a few smaller establishments in the vicinity of Boston. There is also a projected camp for 3000 men on the exposition grounds at Gulfport, Miss. The camp for the Marine Corps at Quantico, Va., has been completed, and the work at Philadelphia, Charleston and Pensacola has also been practically completed.

STILL OTHER SITES ARE PROJECTED

The selection of the sites for these camps has been under the direction of Rear Admiral Palmer, chief of the Bureau of Navigation, and the work of construction is being completed under the direction of Rear Admiral Harris, chief of the Bureau of Yards and Docks. The new quarters for the navy and the Marine Corps, when completed, will provide accommodations for approximately 80,000 men at a cost of $9,000,000.

The cost of the navy construction is naturally much less than that of the army cantonment construction. The army cantonments are expected to house from 500,000 to 1,000,000 men. The majority of the navy structures differ from those of the army in the fact that in the navy structures the men will be furnished sleeping quarters in hammocks instead of in bunks or cots. The navy buildings are uniform, of wood, generally on wooden posts, bringing the floors 2 ft. 6 in. (75 cm.) off the ground. In northern latitudes they are being warmed by steam.

All the navy buildings are lighted by electricity. Their sites have been picked out so far as possible to enable contractors to "hook up" to local electric plants, either light and power plants or street railway plants. The electrical work specified is exposed knob and tube work, made with a view to reducing the fire risk to a minimum. Contracts are based for the navy work on a cost plus 10 per cent basis for work by the principal contractor with an allowance of 5 per cent on work he lets by sub-contract, with the understanding that another person employing labor at the side of the work is a sub-contractor.

The naval establishments are being built in two classes—camps and training stations. Camps are generally places for assembly, to house men near the seaboard, so as to have them in readiness to send to sea, while training stations, such as Newport, Chicago and Jamestown, are of the broader scope in that men are there given a complete course of training.

The size and general character of the mess halls in the navy establishments is quite different from the mess halls of the army and not uniform. At the Philadelphia navy establishment men will be messed in groups of 200; at Jamestown they will be messed in groups of 500; at several other points they will be messed in groups of 1000. At Chicago they will be messed in groups of 1700.

PUBLICATIONS COMMITTEE OF N. E. L. A. OFFERS SERVICE

F. D. Pembleton, Chairman, Suggests Possible Publications Which Will Be Developed if Demand Warrants That Action

F. D. Pembleton, chairman publications committee of the Commercial Section of the National Electric Light Association, writing to the commercial managers, says that the committee desires to assist member companies in every way possible during this crisis and the period of high prices.

The committee could help much more intelligently if it knew just what the central station commercial managers needed, and therefore it suggests a number of possible publications which will be developed if the demand warrants.

The list suggested includes shop-window lighting, store lighting, electrical advertising, seasonable campaign literature, ranges and electric cooking, electricity on the farm, one thousand (or more) uses of electricity, educational literature for instructors in domestic science, electrical comforts for babies, "house organs," street-car cards and display cards.

Recent Court Decisions

Findings of higher courts in legal cases involving electric light, power and other public utility companies.

Reduction in Power to Earn.—Where prior to electric shock a minor was an able-bodied man but at time of trial was suffering from neurasthenia, accompanied by insomnia, loss of appetite and nervous headaches, verdict for $898 was not excessive, the Court of Appeals of Kentucky held (195 S. W., 476).

Liability for Injury to Trespasser.—An electric company which permits its wires to sag so low over a railroad track as to endanger persons on the top of cars cannot, it was held in the North Carolina case of Ferrell vs. Durham Traction Company (L. R. A. 1917 B, 1291), escape liability for the wires throwing a person off a car by the fact that he was a trespasser on the train.

Customer Entitled to Adequate, Not Comparative Service.—In an action for failure to furnish adequate electric power pursuant to contract, testimony regarding the current furnished previous to the contract's execution is inadmissible, even for purpose of comparison, where plaintiff, under the claimed contract, was entitled to adequate and not comparative service, it was held by the Supreme Court of Vermont (100 A. 768) in Roben vs. Ryegate Light & Power Company. The general manager of an electric power company who is also its president has no implied authority to contract to enlarge the plant's capacity. He has authority to bind the corporation by promising a probable customer that the company will not take on more business than it can handle.

Right to Maintain Poles in Highway.—The right of a telephone and telegraph company under its franchise to maintain poles in a highway is qualified by the paramount right of the county authorities to keep the highway in reasonable condition for ordinary use by the public, and the damage which necessarily follows to such licensee from an improvement of the highway without negligence by the county authorities would not be a taking or damaging of property within the meaning of the law which provides that no private property shall be taken or damaged for public or private use without just compensation having been made, it was held by the Supreme Court of Washington (165 P. 102). It follows that if the county is not liable, the contractor, who was the agent of the county in doing the work, and had agreed to do the work in accordance with the plans and specifications of its contract with the county, and under the direction and superintendence of the county engineer, would not be liable, in the absence of negligence on its part being shown.

Question of Negligence in Case of Injury to Young Boy.—For the jury is the question of negligence of an electric company which maintained a highly charged uninsulated wire 34 ft. above the ground, only a few inches above the comb of the roof of a large grain warehouse with a lean-to, the roof of the main part having slope of 32 deg., and that of the lean-to extending to within 8 ft. of the ground, and accessible from the top of cars on a side track, having a slope of only 16 deg., boys of the town having in some degree been in the habit of playing on the roof, and a boy of ten, playing with others thereon, having, like them, taken off his stockings and climbed to the top of roof and taken hold of the wire, thinking, as he said, that it was a telephone wire, the Supreme Court of Washington held in Talkington vs. Washington Water Power Company (165 P. 87). A verdict for $5,500 for injury to a boy ten years old from grasping a high-power electric wire, both hands being severely burned, from which he suffered great pain for two months, requiring dressing by a physician forty-three times, and leaving them deformed and their usefulness permanently impaired to a considerable extent, cannot be said to be so high as to show prejudice of jury.

Powers of Commission in Fixing Rates.—The function of making rates to be charged by an electric power company is legislative, and the only ground upon which the courts may interfere with it is that the specific order impairs constitutional rights, and interference will not be made unless on a clear showing that constitutional rights have been invaded, the Supreme Court of California held in San Joaquin Light & Power Corporation vs. California Railroad Commission (165 P. 16). Where the Railroad Commission fixed 8 per cent as reasonable return on the investment of an electric power corporation and apportioned rates which the corporation asserted would produce but 6½ per cent, the court could not hold as a matter of law that the rate was confiscatory. A power corporation owning hydroelectric plants with extensive water rights is entitled to have the value of such water rights considered in fixing its rates, the water rights being "property." The burden is upon electric power corporation, in certiorari to review an order fixing its rates, to show the existence of any value of property claimed by it. In estimating the value of an electric company's plant for purpose of fixing rates, the value of the company's right to divert 6 per cent of the water from a stream could not be fixed at 6 per cent of the total damage that would accrue to the riparian owners if the entire flowage were withdrawn, such a basis being too speculative. In computing rates of electric power corporation, it was not entitled to charge off a deficit incurred during development period, where the rates indicated that after the development period such deficits had been more than overcome by profits in excess of the standard 8 per cent.

Commission Rulings

Important decisions of various state bodies involving or affecting electric light and power utilities.

New Jersey Companies Ask for a Coal-Price Clause in Rate Schedules.—The New Jersey Board of Public Utility Commissioners has ordered the Bridgeton Electric Company and the Electric Company of New Jersey, operating at Bridgeton and in Gloucester County respectively, to suspend the proposed new light rates as per schedules filed with the board until further hearings are held. The companies propose to adopt a new rate schedule based on the existing price of coal, adding 1 per cent to consumers' bills for each 10 cents per ton of the average cost in excess of $3.50 per ton, the prevailing price at the power plants, and to deduct a like percentage for each 10 cents per ton below this figure that the coal may cost.

Ohio Utilities Get Favorable Ruling.—The Ohio Public Utilities Commission made the following ruling in connection with the application of the Northwestern Ohio Railway & Power Company for leave to increase power rates: "Contracts as to electric power are not binding in any way even if same have been made part of a light ordinance in connection with domestic lighting, as city councils have not the authority or right to regulate power rates for any utility. Each month the utility may file a supplemental rate based upon the actual cost of fuel, labor, material, etc., that have gone into the cost of production of power for that month. However, the commission will not allow increase in ordinance rates to cities and villages for lighting purposes."

Stock Issue Authorized in Massachusetts.—The Massachusetts Gas and Electric Light Commission has authorized the United Electric Light Company, Springfield, to issue 4000 shares of new stock, par value $100, at $185 for such of the cost of enlarging its generating plant as has been incurred subsequent to Dec. 31, 1916, or may be incurred hereafter, "and for no other purpose." The company had asked for authority to issue 5000 shares to meet liabilities now or hereafter incurred for additions and extensions to plant and property. Solomon Lewenberg dissented from the price of $185, upon which Commissioners Weed and Schaff agreed. The board "trusts that the company will enter seriously upon the redemption" of an issue of $250,000 preferred stock given as a dividend to shareholders. It says that "when this preferred-stock dividend was declared the directors of the United company must have realized the need for the enlargement of its generating station for which immediate and substantial provision would have to be made."

Current News and Notes

Timely items on electrical happenings throughout the world, together with brief notes of general interest.

Bonbright & Company, Inc.—Announcement is made that hereafter the investment banking house of William P. Bonbright & Company, Inc., will be known as Bonbright & Company, Inc.

Investigation of Reading (Mass.) Municipal System.—A report of an investigation of the Reading (Mass.) municipal light department has been made by C. W. Whiting, consulting engineer, Boston. The investigation was made for the town.

Value Placed on Property in Albany, Ore.—The Oregon Power Company has placed a price of $250,000 on its property in and adjacent to Albany, Ore. This followed a request of the City Council, which is required by charter to call for a bid from the owners of a public utility before proceeding to install publicly owned works.

Will Sell Municipal Light Plant.—Service Director Hornberger of Cincinnati will introduce an ordinance in the City Council authorizing disposal of the Madisonville municipal light plant at public sale. A resolution to abandon the plant on Aug. 31 was adopted recently. Madisonville is now a portion of the city of Cincinnati.

High Coal Cost May Mean Suspension of Service.—On expiration of its contract for coal the Owingsville (Ky.) Electric Light Company announced that it would probably suspend service. The company has been unable to renew its contract for fuel at a low price. Plans are being discussed for converting the plant into one operated by oil engines, while there is also a possibility that water power will be developed from a nearby stream.

Factory Lighting in Wisconsin.—The Industrial Commission of Wisconsin has requested the United States Public Health Service to co-operate in its campaign for better lighting in Wisconsin. The commission has appointed John A. Hoeveler deputy in charge of shop lighting. The United States Public Health Service has detailed Davis H. Tuck, its illuminating engineer, to co-operate with Mr. Hoeveler in securing better factory lighting.

Investigations for Pittsburgh.—The finance committee of the City Council of Pittsburgh has decided to have investigations made of the electric railway, electric lighting and natural-gas companies. Bion J. Arnold, Chicago, will be employed to investigate the Pittsburgh Railways; Edward W. Bemis, Chicago, is to investigate the Duquesne Light Company, which has announced an increase in rate for natural gas supplied to manufacturers but not to domestic consumers; F. W. Ballard & Company, Cleveland, Clayton W. Pike, Philadelphia, and W. Edgar Reed, Pittsburgh, have also been engaged.

Workmen's Compensation Acts.—The National Industrial Conference Board, of which Frederick P. Fish is chairman and Magnus W. Alexander secretary, has issued a summary of a report issued by the board on "Workmen's Compensation Acts in the United States—The Legal Phase."

Manhattan Electrical Supply Stock Listed.—The New York Stock Exchange has listed $1,121,500 of 7 per cent first preferred and $2,856,800 common stock of the Manhattan Electrical Supply Company, with authority to add $328,500 preferred and $143,200 common, making the totals $1.450,000 preferred and $3,000,000 common.

Buckeye Power Company to Take Over Eastern Ohio Properties.—In connection with consolidation of the Steubenville & East Liverpool Railway, the East Liverpool Traction & Light Company and the Ohio River Passenger Railway as the Steubenville, East Liverpool & Beaver Valley Traction Company, the Buckeye Power Company has been organized to purchase the light and power properties heretofore operated by these companies.

Western Ohio Railway Company Increases Power Business.—In explaining its reason for omitting the July dividend to the first preferred stockholders, the Western Ohio Railway Company, Lima, stated that the growth of power business had so far exceeded expectations that $37,336 of its funds available for dividends had been turned to capital account in the development of this field, in comparison with $7,166 for the previous year. The income from this source for the year ended May 31, 1917, was $221,425, while for the previous year it was $160,003. For the seven months ended May 31 there was an increase of 18½ per cent in the output. However, coal cost $48,943, or 108 per cent more for the same period. These two items, the company states, made it advisable to omit the dividend for the period.

Electro - Metallurgical Plant for South.—By reason of hydroelectric power available from nearby plants it has been possible for Chattanooga, Tenn., to add an industry that is not only new in that city but is the first of its kind in the South. Ferro-alloys for the manufacture of steel will be produced by the Southern Ferro-Alloy Company, capitalized at $210,000 and incorporated under the laws of Tennessee. Preliminary work on the plant has been begun. The power contract placed by the Southern Ferro-Alloy Company with the Tennessee Power Company was the largest single order for energy ever given by a company in Chattanooga, calling for 3000 hp. All electrical equipment contracts have been placed. The plant was designed by the Fitz-Gerald Laboratories, Niagara Falls, N. Y. The president of the new industry, P. J. Kruesi, is active head of the American Lava Company, Chattanooga.

Associations and Societies

A complete Directory of Electrical Associations is printed in the first issue of each month on the next-to-last text page.

Utah Section, A. I. E. E.—A. S. Peters has been elected secretary of the Utah Section of the A. I. E. E.

Boston Section, A. I. E. E.—At a recent meeting of the Boston Section of the A. I. E. E., I. M. Cushing was elected secretary.

Chicago Section, A. I. E. E.—C. A. Keller was elected secretary of the Chicago Section of the A. I. E. E. at a recent meeting.

International Association of Municipal Engineers.—The annual convention of the International Association of Municipal Engineers will be held at Niagara Falls, Sept. 11-14 inclusive. Clarence R. George of Houston, Tex., is secretary.

Association of Iron and Steel Electrical Engineers.—The eleventh annual convention of the Association of Iron and Steel Engineers will be held at the Bellevue-Stratford Hotel, Philadelphia, Sept. 10 to 14 inc. Wednesday, Sept. 12, will be devoted entirely to a patriotic program, with addresses by army and navy engineers on vital subjects concerning the industries.

San Francisco Electrical Development and Jovian League.—At the June 27 meeting of this association, the last gathering until September, six past-presidents of the organizations were present to make brief talks about the association—what its experience has shown, how its activities should be broadened, and what opportunities the future holds in store for it. As a number of members have gone or are going to the front in Europe, it was decided to appoint a committee whose function would be to see that the men thus entered upon the "honor roll" should be kept in touch with activities of the organization and that, in turn, reports from the men should be received by the association.

Empire State Gas and Electric Association.—On July 13 the second meeting of the electric production committee of the Empire State Gas and Electric Association was held at the Hotel Iroquois, Buffalo, N. Y. The principal subjects of the meeting were "Power-House Organization," "Hours of Labor" and "Wages and Bonuses." The executive committee of this association at its regular monthly meeting in June voted that the committee on war measures investigate the question of methods of conserving the coal supply. The committee also approved the investment of $1,000 of the association's funds in Liberty Loan bonds. It was also decided that the annual meeting of the association be held on Friday, Oct. 5.

F. J. POSTEL

Men of the Industry

Changes in Personnel and Position— Biographical Notes

Fred J. Postel, consulting engineer, Chicago, has been appointed State supervising engineer for Illinois. In this capacity he will have charge of the operation and maintenance of all institutional power plants in the State and of the design of all new plants for such places. His jurisdiction covers not only the electrical but also the mechanical and hydraulic equipment of some thirty plants. In 1898 Mr. Postel served as a sergeant in the Second Volunteer Engineers for the Spanish-American War. In 1899 he was graduated from the University of Illinois with the degree of electrical engineer. From 1899 to 1905 he worked with Charles G. Armstrong, consulting engineer, Chicago. In 1905 he entered the consulting engineering business, forming the firm of Postel & Linn. In 1910 he acquired Mr. Linn's interest in the company and renamed the firm Fred J. Postel & Company. Mr. Postel is the representative of the Western Society of Engineers on the Chicago Commission of Ventilation; he is also a member of the American Institute of Electrical Engineers. As consulting engineer for the Miller's Mutual Fire Insurance Companies, he wrote the first electrical codes for that organization.

W. H. Price, for the past six years general manager of the Etowah (Tenn.) Water & Light Company, has resigned to accept a position as secretary and general manager of the Crystal Ice & Cold Storage Company of Etowah. This company owns an electrically driven raw-water ice plant.

C. E. Bennett, for the last two years mechanical and electrical engineer for Hugh L. Thompson, Waterbury, Conn., has resigned his position to become associated with Curtis A. Mees, consulting engineer, Charlotte, N. C. Prior to becoming identified with Mr. Thompson Mr. Bennett was electrical engineer for the Northern Contracting Company and the Georgia Railway & Power Company of Atlanta and was principal assistant to Charles O. Lenz on the Tallulah Falls development in Georgia. Previous to this time he had been associated with L. B. Stillwell and the J. G. White Company of New York City.

Allen M. Schoen, chief electrical engineer of the Southeastern Underwriters' Association, Atlanta, Ga., is a member of the newly appointed Board of Consulting Engineers of the city of Atlanta. The purpose of this board, the idea of which originated with Mr. Schoen, is to take politics out of city engineering. The board has five members, who are engineers of the highest reputation. Mr. Schoen is particularly well known in the electrical field, being a fellow in the American Institute of Electrical Engineers and having been at one time one of the managers of that body. He was born in Richmond, Va., in 1869 and when twenty years old was graduated from the Virginia Military Institute, after which he took up civil engineering as a profession. Later he took up electrical engineering, and in 1892 he was engaged as an electrical expert at the Lynn (Mass.) factory of the Thomson-Houston Electric Company. He afterward became assistant superintendent of the Richmond (Va.) Railway & Electric Company, from which position he resigned to become electrical inspector for the Southeastern Underwriters' Association. He has been associated with this organization ever since. He was a member of the electrical committee of the Underwriters' National Electrical Association, which formulated the National Electrical Code, and he has written considerably on technical subjects. He recently received a commission as Class A major in the Officers' Reserve Engineering Corps, and while not in active service at present, is acting in an advisory capacity in connection with the Silver Lake cantonment and locating drill grounds for the Seventh Regiment of Engineers.

Samuel Lindsey Nicholson, who has been sales manager of the Westinghouse Electric & Manufacturing Company since 1909, has been promoted to the position of assistant to vice-president, with headquarters at East Pittsburgh. Mr. Nicholson was born in Philadelphia, received his education in the William Penn Charter School of that city, and began his business career as an apprentice with the Belmont Iron Works in 1887. He became associated with the Novelty Electric Works in Philadelphia the following year, and a few months later accepted a position with the Chadbourne-Hazelton Company of Philadelphia, sole sales agent for the Sprague Electric Railway & Motor Company. This company organized the Equitable Electric Railway Construction Company, and Mr. Nicholson was sent to Reading, Pa., as assistant superintendent of construction

S. L. NICHOLSON

to build the Neversink Mountain Railway. Returning to Philadelphia, he was placed in charge of the sales of dynamos and motors of the Wenstrom Dynamo & Motor Company of Baltimore. Later he was sent by the Equitable company to Bristol, Tenn., to build the Bristol Belt Line Railway. In 1892 he became connected with the Philadelphia office of the Short Electric Company and subsequently with the New York and Cleveland offices of this company. Upon the absorption of the Short company by the General Electric Company in 1893 Mr. Nicholson accepted a position with the Technic Electric Works, Philadelphia, owned by Pepper & Register, contractors, who had the contract for the construction work incident to the electrification of a number of the street railways in Philadelphia. After a year's work as superintendent of this company, Mr. Nicholson went with James Boyd & Brothers, agents for a number of mill supply concerns, and organized for them an electric railway supply department. In 1896 he joined the forces of the Cutter Electric & Manufacturing Company and successfully exploited for them a new circuit breaker A year later he went with the C. & C. Electric Company, as sales representative in New York City, where he introduced the company's engine-type generators and stationary motors. In 1898 Mr. Nicholson became sales representative of the Westinghouse company in New York City, subsequently having charge of the city and industrial division of the New York office. On the reorganization of the sales department in 1904 he was made manager of the industrial department, which position he successfully filled until his selection as sales manager of the company in 1909.

Obituary

Frank L. Stearns, electrical engineer for the Chicago, Milwaukee & Puget Sound electrification, died recently as the result of inhaling gas and smoke caused by the burning of insulation in the substation of the East Portal of the long tunnel of the company in western Montana.

REVIEW OF TRADE AND MARKET CONDITIONS

News of the Trade for the Manufacturer, Wholesaler and Jobber of Electrical Equipment and Supplies—Notes on Industrial Activities and Business Methods

SITUATION IN LAMP MARKET BECOMES MORE PROMISING

The Period of Greatest Stress Is Now Felt to Be Past—Tendency Toward Even 25-Watt Sizes Is Becoming Evident

At present an optimistic note seems to prevail in the incandescent lamp situation. It is confidently believed by lamp manufacturers that the period of greatest stress is past, and that the future will see the beginning of a restoration of balance between supply and demand.

Since the development of incandescent lamps for commercial use manufacturing processes have been perfected which permitted the manufacture in 1916 of 154,000,000 lamps. No figures are yet available relative to the probable production for 1917. However, there is less anxiety in the market this year than was apparent a twelvemonth ago, due partly to a less disturbed view of the situation and partly to the time-saving and labor-saving lamp-making machinery developed within the last two years. Factory capacities are also being increased as rapidly as the labor and material market will permit. General facilities for lamp production are being increased through improved processes and increased space.

Labor market conditions have influenced lamp production to a considerable extent, but difficulty from this source is thought to be practically past.

There is a noticeable tendency of demand toward "even 25" wattages, with a corresponding falling off of demand for the heretofore most popular 40-watt and 60-watt sizes. It is believed that the higher standards of illumination now prevalent affect this tendency and will govern it to the possible elimination of the 40-watt and 60-watt lamps in favor of the 50-watt and 75-watt sizes.

MANUFACTURERS OF WIRE WORK WITH GOVERNMENT

Committee Formed to Accept All Orders, Make Binding Prices and Apportion Orders Out Among Manufacturers

Insulated wire and cable manufacturers have been very active in lending their support to the government since a state of war was declared. Immediately the United States entered the war practically every wire manufacturer placed his entire organization at the disposal of the national government.

Now this co-operation is taking on a more tangible form. The manufacturers were called to Washington recently to confer with navy officials and at that time three of their number, LeRoy Clark of the Safety Insulated Wire & Cable Company, Edward Sawyer of the Atlantic Insulated Wire & Cable Company and Wallace Clark of the General Electric Company, were appointed a committee to represent the entire insulated wire and cable industry in connection with purchases of wire by the Navy Department.

It was then agreed that all navy orders for insulated wire should pass through this committee's hands. The prices would be fixed between this committee and the Navy Department and the committee would distribute all work of manufacture, the distribution to be made according to the capacity of the plant and to the ability of the manufacturer to ship promptly.

The wire manufacturers have agreed to these conditions, and already they are in force and orders have been placed by the government in accordance with them.

From the standpoint of the government this offers one of the best possible ways of placing orders. No favoritism is shown and orders are placed in such a way as least to disrupt the market and assure quickest deliveries.

No individual manufacturer is loaded down with government business, the market is stabilized, and the effect on the trade is much smaller than it would be otherwise.

Prices are based on a certain wire base, the copper for which the government agrees to furnish. By the manufacturer, of course, this is welcomed, because he does not have to sell to the government his own stock of copper at considerably less than he paid for it or could replace it for.

The first order was for 1,000,000 ft. of lead-covered submarine cable, which was wanted right away. This order, which would normally have required eighteen months to fill, was accepted and deliveries commenced in thirty days. In sixty days the order was completed. This order was followed by orders for several million feet of other kinds of cable, which were apportioned among sixteen manufacturers.

Prices on this business, it is understood, were much better than the government could have made in the market, and deliveries were much quicker than they would otherwise have been. Therefore, from the standpoint of the government, this method of handling orders has been found to be very satisfactory and very reasonable.

EDUCATING THE RETAILER IN USE OF DEALER HELPS

Western Electric Company Has Compiled a Book Containing All of Its Dealer Helps, Showing How to Tie Up with National Publicity

It has frequently been said that there are three classes of merchandisers—(1) those who depend entirely on their own advertising efforts, (2) those who freely use dealer helps as prepared by the manufacturers and jobbers, and (3) those who do little or no advertising and have no policy in that direction.

The second group is here considered. It includes largely concerns that believe in advertising but which financially are not able to pay for it and have not within their organization the ability to put out convincing copy, booklets, window displays, folders, etc. This group is undoubtedly the backbone of the retail distribution of merchandise.

Each year tons of dealer helps are distributed promiscuously to the trade and central stations on electrical merchandise, a considerable quantity of which brings to the manufacturer or jobber absolutely no return. There is no doubt that in a large number of instances the plan of distributing this material is unsound, principally because the dealer has not been properly educated in the use thereof. It is no uncommon sight to see this stuff thrown into vacant houses, cellars, ash cans, etc., nor infrequently are windows found put together in haphazard fashion and allowed to remain until the material is fly-specked, dusty and unsightly.

Dealers have not been taught how properly to use these dealer helps, on which the national distribution has put the energies of its high-priced advertising specialists, to tie up with national advertising.

Now that paper is so high, the problem of getting results out of dealer helps becomes more acute. Distributers are

now considering how to place these dealer helps that they may produce maximum returns. For this reason the book recently put out by the Western Electric Company entitled "We Are Selling the Idea! Are You Selling the Goods?" is of unusual interest.

In this twenty-eight-page book are found samples and reproductions of that company's complete line of free selling helps designed for the retailer's use. The book has been put together with a constructive plan. Each piece of merchandise is described, and with it are shown the dealer helps that pertain to that product. Also, the selling points of that product are plainly stated so that the retail distributer can merchandise on a firm basis. Details of construction are indicated and explained. Information is included on how to use the dealer helps.

Reproductions of the national advertising of that company are included with information on how to use dealer helps to tie up with it.

The book has this message: If the national advertising that this company is doing is to mean increased business for the dealer, it is up to him to make it easy for the public to buy the articles that it wants.

EFFECT OF THE WAR ON OUR EXPORTS TO CANADA

Investigation Reveals No Material Increase in the Volume of Trade with the Dominion as Regards Electrical Goods

Reports were prevalent a few weeks ago that the entry of the United States into the war in Europe had stimulated to a considerable degree electrical trade with Canada. While such reports may have been true for other manufacturing industries, a careful investigation has disclosed no material increase in electrical exports to Canada. In fact, in some instances it was found that America's entry into the war was a signal for decreasing trade. This was found to be particularly true of the Canadian paper and pulp industry, much of the electrical equipment for which is of American manufacture. A number of projects were scheduled for development shortly, but simultaneously with the entrance of America into the war these plans were either abandoned or postponed indefinitely.

Of course, it must not be lost sight of that some of the larger American manufacturers have established Canadian factories or have connections in Canada in which they have substantial interests whereby goods of Canadian manufacture but identical in design with American goods are marketed in Canada. These plants, which are largely financed by American capital and buy probably most of their raw materials from the United States, have been established in Canada as a means to compete in the Canadian market without the necessity of having to pay import duty.

MARKET ABROAD FOR HEATING AND COOKING APPLIANCES

High Cost of Coal in Foreign Countries Stimulates Export Demand for Electrical Merchandise from America

Owing to the high price of coal abroad there is a strong foreign demand for electric heating and cooking apparatus. It is doubtful, however, if much of this trade can be handled by American manufacturers because they are working to capacity on domestic orders placed long ago. Present incoming business is slow, and if manufacturers are not booked too far ahead the foreign business may prove to be very beneficial to manufacturers in a few months.

To engage very actively in this market it may be necessary for American manufacturers to change appliance design and perhaps to specialize on certain appliances not in great demand in the United States. Little has been done to develop products, especially for the foreign market, probably because the demand has not previously warranted it.

THE WEEK IN TRADE

WITH the exception of household appliances there was little change in prices during the past week. The staples seem to be holding up well and prices are maintained. The demand stiffened this week all along the line, and a number of inquiries of large size were made. Some contracts for cantonment supplies were awarded at prices very favorable to the government. Deliveries appear to be getting better as time goes on, and before winter comes it is hoped that they will be much nearer to normal.

Dealers are right now in what is normally the fan season, but owing to the unseasonableness of the weather from coast to coast retail sales are very small. Dealers purchased heavily this year, and unless some real prolonged hot weather comes soon heavy stocks will be carried over, as happened in 1915.

NEW YORK

There was little or no change in general conditions during the week. Prices for staples were maintained, and there was little indication of any sudden change in the near future. Inquiries were particularly good during the week, and the volume of business is being maintained at its height. There is, of course, a big market for wiring supplies and fittings for cantonments, while the demand for general building is slowing up in a very marked way. Practically the only building outside of cantonments showing any considerable activity is that for industrial purposes. Distributers of specialties sold to department stores have been asked to hold up their deliveries inasmuch as the stores are curtailing their buying as far as possible. Deliveries are getting better, barring porcelain, on which, owing to the strike, orders are very far behind. Manufacturers since the first of June have been seeking more and more to effect collections, in which they have been generally very successful.

WIRING SUPPLIES.—Prices have been maintained during the last week with no indications at present of a change in price, either up or down, in the near future.

INSULATED WIRE.—The last few days have brought forth an increase in the volume of inquiries and orders, the most important of which are those for the cantonments. Most of the wire for these cantonments is No. 14 size. An initial order was placed in this district during the last week for 9,000,000 ft. to 10,000,000 ft. of this wire. Further orders will be placed from time to time as the work progresses. These orders are being divided up among different manufacturers, according to available capacity and ability to ship promptly. Prices are based on a certain wire base, copper for which the government furnishes. Very small stocks of large-size wire are being carried now by manufacturers, and it is consequently rather difficult to place an order for other than government purposes. In addition to the material for cantonments, considerable submarine cable has been purchased. While there is slight fluctuation in electrolytic copper, there was no change in the price of wire during the week.

POLE-LINE HARDWARE.—The demand for this class of material is very large, but it is extremely difficult to obtain supplies owing to the general steel conditions. There has been no change in prices.

ELECTRIC RANGES.—The third increase in three months went into effect on June 15. While not all ranges were affected, the average increase on those affected was about 10 per cent. The demand has increased considerably, and it has been found very difficult to obtain sufficient stock owing to the conditions in the steel market.

ELECTRIC FLATIRONS.—An increase on certain irons of 50 cents goes into effect on July 15, bringing the price of irons up to $5.50 or $6, as the case may be. It is expected that the minimum price on irons will be $6 before long. The new business in flatirons has decreased because central stations and dealers were stocked up prior to the advance in price to what was considered to be their full 1917 requirement.

VACUUM CLEANERS.—There was an increase in the price of vacuum cleaners of about 10 per cent on July 1, owing to the increased cost of manufacture. One item in this increase is rubber hose, which has gone up about 120 per cent. Another big factor is motors, which are costing considerably more. There has been an unusually brisk demand for the larger type of machine, especially from factories. Machines for office buildings, hotels, etc., have also sold very well, while stationary cleaners have been selling as in normal times.

FANS.—The largest manufacturers are practically sold out of fans. The demand this year is very great, and it came not only from the regular electric channels but also from other merchandising channels such as furniture houses and drug stores. Owing to the unseasonable weather, which has been cool and rainy, the sale of fans in this territory by dealers has been less than normal. Unless some prolonged and very hot weather comes shortly there is every indication that dealers will carry an unsually large stock over to next year.

WASHING MACHINES.—On account of the difficulty in getting domestic help, owing largely to the big drop in immigration, the demand for washing machines has been unprecedented.

CHICAGO

The lighting sales section of the industry has been busy in the last week figuring on cantonment jobs. Reports coming from Rockford, Ill., and from Rantoul, Ill., tell of the amazingly rapid construction going on in those camps. At Dayton it is said that immediate delivery on motors to drive construction machinery was secured by taking idle direct-current machines out of a large industrial plant in the city. Conditions have been somewhat upset in the contracting trade at Chicago by a lockout. There have been a few changes in prices, the trend being upward.

The condition of jobbers' stocks in the Kansas City territory is probably better to-day than it has been at any time during the past few years. Deliveries along certain lines, are still poor, but improvements have been noticed in many lines, particularly in manufacturers' stocks of rubber-covered wire. The customers of jobbers as a rule are operating on low stocks, and are buying only for their immediate needs, owing to the fear that a break in the market may occur at any time. Advices from a representative jobbing house in the Kansas City territory are to the effect that its sales are holding up well and its volume is approximately 40 per cent greater than the corresponding period of last year. This has been somewhat of a surprise as jobbers in that territory have been led to believe that the extremely high prices would decrease the demand to such an extent that increased prices would not make up the volume of business done last year.

There is very little going on in the building line, but the activity in the oil and mineral section of Missouri, Kansas and Oklahoma has been sufficient to keep up an active market. There has also been more or less activity in municipal work. A number of the small towns in Kansas and Oklahoma are installing municipal lighting plants, and others are making improvements and additions to existing plants. Collections are good on the whole in the Kansas City territory.

ELECTRIC RANGES.—When war was first declared the electric range industry expected a slump in orders. Its belief that this falling off would occur was soon increased by the news that automobile retailers were feeling a tightening up. To date, however, this expected decrease in range business has failed to materialize. Orders are continuing to come in at the regular rate. The surmise is, however, in view of these conditions, that if the feeling of uncertainty caused by war had not developed the influx of orders would have been enormous.

RUBBER-COVERED WIRE.—Slight fluctuations occurred in prices of the larger sizes of rubber-covered wire, although the prices were on the whole very steady.

FLATIRONS.—Prices on flatirons increased from the quotation of the former week, which was $3.75 to $3.85, to $3.75 to $4.20.

BOSTON

A slight reduction in the volume of business is noted in New England electrical jobbing circles at present, and the advent of the two principal vacation months is without doubt a factor in the situation. The country is settling down to work on a war basis, and each week sees less fear of any serious disorganization of the electrical industry on this account. New England is a region of intensive manufacturing, and the diversified products of its shops and mills exert a very favorable influence on electrical consumption both of goods and of energy. War orders are still being filled in the Northeast, and the demands of the government upon the textile industry and upon the machinery makers are important sources of revenue, whose good effects are felt all along the line.

High prices of material and labor have discouraged residential building this year, and central stations are in many cases looking askance at extensions unless the revenue from these is unquestioned and immediately in prospect. Credits are a little below normal in some quarters, collections being a trifle slow. Prices are about the same as a week ago, except that an advance of $1 in the retail selling price of several representative makes of electric flatirons took place July 10. Deliveries are improving on the whole.

The second-hand electrical machinery market is not quite so active as a few weeks ago, and one prominent dealer advised the ELECTRICAL WORLD that there is a slight falling off in the demand for motors, due in his opinion to the uncertainties of the legislative situation at Washington with respect to the revenue bill. There is no question that the failure of the Interstate Commerce Commission to rise to the occasion and recognize the financial needs of the railroads in its recent decision was a blow against business confidence, particularly in view of the absence of the former volume of opposition to a substantial rate increase. The fundamentally sound electrical industry in New England is, of course, not directly affected by this decision, but its indirect effect in threatening railroad credit and restricting purchasing power, at a time when "Full speed ahead!" should be the motto of regulating bodies and operating organizations alike, is bound to be unfavorable.

The electric railway situation in New England looks slightly better. Fare increases are beginning to be seen to be necessary, even by the public, and one of the most heartening events of recent months in this great field of electrical activity was the recent "getting together" of the Bay State Street Railway and a large and representative portion of its public before the Massachusetts Public Service Commission in the interests of higher fares for a six months' trial period.

ELECTRIC FANS.—Subnormal temperatures have much hampered the distribution of fans in New England this summer. Retail stocks are being depleted slowly by a sustained demand which increases sharply for a short time following a day or two of seasonable heat, but as New England has had no protracted hot waves as yet, the general movement of fans cannot be regarded as satisfactory.

STORAGE BATTERIES.—Business is poor in isolated plant batteries, but it is excellent in equipment for industrial electric truck service. Batteries for navy yard and submarine chaser service are in much demand, and manufacturers are accumulating a fair stock of lighting and starting batteries for automobile service ready for early shipment. Contrary to the opinion expressed in some quarters, government work is not interfering with commercial orders to any great extent. No immediate price advances are in sight unless material or labor costs rise.

INDUSTRIAL ELECTRIC TRUCKS.—These little equipments are enjoying a rapid increase in popularity in New England. Prominent dealers are very busy in campaigns for better efficiency through this form of industrial transportation, and the outlook was never so good as at present. It is said on good authority that no price advances are at present in contemplation, the effort being to lower unit production costs by prorating them over an increased volume of business.

ELECTRIC MOTORS.—These continue in demand, and one central station which maintains a normal stock valued

at $25,000 has had its motor inventory depleted to $5,000 by the industrial requirements of its territory. Consequently it is purchasing motors from all possible sources, and former discriminations are held in abeyance. Deliveries on motors of over 5-hp. rating are still affected by the necessary preference given to government orders, but in the small sizes earlier shipments are being obtained and stocks are larger. No immediate price changes are in sight.

FLOODLAMPS.—Business is good in these equipments, but a summer lull is beginning to be felt. Manufacturers' stocks are beginning to accumulate somewhat, and immediate shipments can be made in many standard types. The first rush of the military demand has been met. A large demand is a feature of the market for new units of 1000-watt to 500-watt rating for railroad yard and other extended-area outdoor lighting. Deliveries can be made in from two to four weeks on the newer styles. It is rumored that a further price advance on floodlamps may be put into effect about Aug. 1.

LAMPS.—The volume of business holds well to previous outputs. Deliveries are improving rapidly, especially with respect to standard lamps.

WIRE AND CABLE.—After an active spring, a falling off is noted in domestic wire and cable orders. The small amount of house wiring and central station line extension work put through this year has been a factor in this situation. Stocks are now accumulating as a result of the ability of cable manufacturers to obtain bare wire and on account of the reduced demand. Twelve months ago a representative manufacturer could not keep a foot of No. 14 wire in stock over night. Within a comparatively few days an order of 1,000,000 ft. of this size for army cantonment service was filled inside of thirty-six hours. The opinion is held that high wages should lead by fall to a broadening of the market for wire, especially in house equipment work. Under present conditions there is little prospect of further stiffening of prices.

ATLANTA

There is no change in the general situation and all lines seem to be enjoying a good business. A little uncertainty, exists however, regarding the future, not that the trade expects a falling off, but rather as to how much business it should prepare for. Jobbers and contractors find it hard to anticipate government requirements for the federal prison additions, German prison barracks at Atlanta, Silver Lake cantonment and other training sites in the Southeast, since it is rumored that all orders for large quantities of material may be placed direct with the manufacturers instead of depending on present local and scattered stocks. However, manufacturers and jobbers report a very healthy condition and good collections.

Contracting business is very active, especially in the industrial field. Residence and building work is normal, with collections fair.

TRANSFORMERS.—Increasing prices and long shipments do not seem to affect the demand for larger sizes; shipments on the smaller sizes show no change.

MOTORS.—Demands are less urgent owing to federal investigation of coal situation. Stocks depleted in all but fractional horsepower sizes.

COPPER.—Prices are steady and stocks very low.

CONDUIT.—A steady demand exists despite uncertain prices. Stocks are depleted with the exception of a few holdings.

CABLE.—Requirements show wide variation and long deliveries are expected. Orders are being placed for November deliveries on varnished cambric.

METERS.—There is a strong demand for all standard sizes with reasonable deliveries.

LAMPS.—Buying is scattered. Stocks are sufficient to handle additional demands.

HEATING APPLIANCES.—The recent price advance has curtailed immediate demands. Stocks are in fair shape.

WIRE.—Southeastern stocks will be badly depleted if the government calls on this section for training camp needs.

WIRING DEVICES.—The market is active with a much better outlook for increased volume of buying. Stocks appear to be able to stand the pressure.

POLE AND LINE MATERIAL.—Demands are increasing slightly. Prices on glass insulators are advancing and improved shipments are reported. Hardware prices are strong and deliveries are uncertain.

FANS.—The delayed seasonal weather came with a rush, causing a brisk movement of the popular 8-in. to 12-in. fans. Stocks, however, bearing up well.

SEATTLE

No particular change in stock conditions was noticed by Northwest dealers during the week July 3-10. There was a slight increase in price of wiring devices purchased for fall and winter stocks. Buying continues to be conservative. Demands of shipbuilding concerns are holding up.

During the week a slight falling off in sales of electrical material was noted. While there was a small advance in the real estate market, there were no noticeable changes in demands for building material, as prospective builders are withholding intended operations until materials decrease in price.

Freight is moving about the same as during the last two weeks. As yet no decision has been made as to whether material for the American Lake (Wash.) cantonment will be purchased in the East or in the West. Credits and collections are good.

COPPER.—Quotations remain unchanged. Strikes at the mines, while having no immediate effect on the available supplies, if maintained will considerably decrease fall and winter supplies, with a consequent jump in price.

CONDUIT.—Prices are unchanged, but indications are that there will be further advances in the near future, and that a sufficient supply will be difficult to obtain.

DOMESTIC APPLIANCES.—The market for heating and other appliances used in the home remains about the same, due to the unseasonable weather.

FANS.—There is very little movement on fans or other hot-weather appliances, as the season is always short in the Northwest.

METAL MARKETS CONDITIONS

Slight Falling Off Noted in Copper and Brass Quotations—Tin Stronger

The week was generally weak in metal transactions. Tin strengthened somewhat, while there were further concessions in electrolytic copper and brass. Holders of copper seemed inclined to part with some of their stocks on Monday at prevailing market prices. The strikes out in the mining regions may have a serious effect on fall and winter deliveries, but since the smelters have sufficient supply to keep them going for a couple of months the labor situation is having but little effect on the spot and summer supply.

Nominal quotations on electrolytic were as follows on Monday last: July, 31 cents; August, 30 cents; third quarter, 30 cents; fourth quarter, 28.75 cents.

NEW YORK METAL MARKET PRICES

	July 2	July 9
Copper:	£ s d	£ s d
London, standard spot	130 0 0	130 0 0
Prime Lake	30.50 to 31.50*	30.50 to 31.50*
Electrolytic	31.50 to 31.75*	30.75 to 31.25*
Casting	29.25 to 29.75*	29.00 to 29.25*
Wire base	37.00 to 38.00*	37.00 to 38.00*
Lead, trust price	11.00	11.00
Nickel, ingot	50.00	50.00
Sheet zinc, f.o.b. smelter	19.00	19.00
Spelter, spot	9.17½	9.12½
Tin, Straits	62.00	62.75
Aluminum, 98 to 99 per cent	55.00 to 57.00*	54.00 to 56.00*

OLD METALS

Heavy copper and wire	27.50 to 27.75	26.50 to 27.00
Brass, heavy	17.00 to 17.50	15.50 to 16.00
Brass, light	14.00 to 14.50	13.50 to 14.00
Lead, heavy	10.00 to 10.25	9.50 to 9.75
Zinc, old scrap	6.75 to 7.00	6.50 to 6.75

*Nominal.

Current Prices of Electrical Supplies

NEW YORK AND CHICAGO QUOTATIONS

The prices quoted are those prevailing in standard package or specified lots on apparatus and appliances in Eastern and Middle West markets at the beginning of business on Monday of this week. They are in all cases the net prices or prices subject to discounts from standard lists to contractors, central stations, dealers and others engaged in the resale of such goods.

Prices in Southern and other nearby markets will rule about the same as those in the Middle West, although slight modifications to cover increased freight and local demands should be expected. In the Far West and on the Pacific Coast the prevailing prices are naturally higher, covering as they must increased freight and the necessity of larger stocks with increased interest and warehouse charges on account of the distances from sources of supply, infrequent turnover of stock and uncertainty as to delivery of goods in transit. Moreover, the Far West presents a wide variation in demand due to a small population spread over a wide area in agricultural and mining communities, as contrasted with the denser population of the East and Middle West, their nearness to the source of supply, the more frequent turnover in stocks and the constant demands which arise in industrial centers.

The variation in prices may be due to the difference in grade of products made by different manufacturers, to local conditions or to both.

ARMORED CONDUCTORS, FLEXIBLE STEEL

Single-Conductor

B. & S. Size	List, per 1000 Ft.
No. 14 solid	$61.00
No. 12 solid	71.00
No. 10 solid	90.00
No. 8 solid	106.00
No. 6 solid	145.00
No. 10 stranded	95.00
No. 8 stranded	115.00
No. 6 stranded	160.00
No. 4 stranded	205.00
No. 2 stranded	266.00
No. 1 stranded	315.00

Twin-Conductor

No. 14 solid	104.00
No. 12 solid	135.00
No. 10 solid	185.00
No. 8 stranded	235.00
No. 6 stranded	370.00
No. 4 stranded	575.00

NET PRICE PER 1000 FT.—NEW YORK

Single-Conductor

No. 14 solid:	
Less than coil	$54.90 to $61.00
Coil to 1000 ft	48.80 to 59.17
No. 12 solid:	
Less than coil	63.90 to 71.00
Coil to 1000 ft	56.80 to 68.87

Twin-Conductor

No. 14 solid:	
Less than coil	$78.00 to $104.00
Coil to 1000 ft	75.00 to 80.00
No. 12 solid:	
Less than coil	121.50 to 135.00
Coil to 1000 ft	108.00 to 130.95

CHICAGO

Single-Conductor

Discount ..... +10% to 10%

Twin-Conductor

Discount ..... —10% to 10%

ATTACHMENT PLUGS

List ranges from $0.22 to $0.30 each.
Standard packages from 100 to 250.

DISCOUNT—NEW YORK

Less than 1/5 std. pkg	+12% to 10%
1/5 to std. pkg	10% to 20%
Std. pkg.	24% to 44%

DISCOUNT—CHICAGO

Less than 1/5 std. pkg.	12% to +20%
1/5 to std. pkg.	20% to List
Std. pkg.	30% to 44%

BATTERIES, DRY

NEW YORK

Each Net	No. 6 Regular	No. 6 Ignitor
Less than 12	$0.40	$0.40
12 to 50	.35	.35
50 to barrel	.31	.32
Barrel lots	.28	.29

BATTERIES, DRY—Continued

CHICAGO

Each Net	No. 6 Regular	No. 6 Ignitor
Less than 12	.39 to .40	.39 to .40
12 to 30	.34 to .35	.34 to .35
50 to barrel	.29½ to .31¾	.30½ to .32¾
Barrel lots	.28 to .28¾	.29 to .29¾

CONDUIT, METALLIC FLEXIBLE

Size, In.	Ft. per Coil	List per 100 Ft.
5/16	250	$5.00
⅜	250	7.50
½	100	10.00
¾	50	13.00
1	50	21.00
1¼	50	26.00
1½	25-50	35.00
2	25-50	45.00
2½	25-50	52.00

NET PER 1000 FT.—NEW YORK

	Less than Coil	Coil to 1000 Ft.
⅜-in. single strip	$67.50 to $75.00	$60.00 to $68.75
⅜-in. double strip	71.75 to 75.00	63.75 to 72.00
½-in. single strip	90.00 to 100.00	80.00 to 93.00
½-in. double strip	95.00 to 100.00	85.00 to 96.00

NET PER 1000 FT.—CHICAGO

	Less than Coil	Coil to 1000 Ft.
⅜-in. single strip	$71.25 to $75.00	$60.00 to $63.75
⅜-in. double strip	75.00 to 78.75	67.50 to 71.25
½-in. single strip	95.00 to 100.00	80.00 to 85.00
½-in. double strip	100.00 to 105.00	90.00 to 95.00

CONDUIT, NON-METALLIC FLEXIBLE

Size, in.	List, per Foot	Size, in.	List, per Foot
7/32	$0.05½	1	$0.25
¼	.06	1¼	.33
⅜	.09	1½	.40
½	.12	1¾	.47
⅝	.15	2	.55
¾	.18	2¼	.65

NET PER 1000 FT.—NEW YORK

Less Than $15 List	$15 to $60 List	$60 to $150 List
7/32-in., $36.67-$55.00	$24.50-$27.15	$21.50-$24.75
¼-in., $40.00-$60.00	$27.00-$30.00	$23.50-$27.00

NET PER 1000 FT.—CHICAGO

Less Than $15 List	$15 to $60 List	$60 to $150 List
7/32-in., $36.66-$55.00	$27.50	$23.10-$24.75
¼-in., $40.00-$60.00	$30.00	$25.20-$27.00

CONDUIT, COUPLINGS AND ELBOWS, RIGID IRON

Card No. 38

Size, in.	Conduit, List per Foot
¼	$0.08½
⅜	.08½
½	.08½
¾	.11½
1	.17
1¼	.23
1½	.27½
2	.37
2½	.58½
3	.76½

	Couplings, List	Elbows, List
¼	$0.05	$0.19
⅜	.06	.19
½	.07	.19
¾	.10	.25
1	.13	.37
1¼	.17	.45
1½	.21	.60
2	.28	1.10
2½	.40	1.80
3	.60	4.80

DISCOUNT—NEW YORK

	¼ In. to ½ In.	¾ In. to 3 In.
Less than 2500 lb.	6% to 8%	8% to 10%
2500 to 5000 lb.	9% to 11%	11% to 13%

(For galvanized deduct six points from above discounts.)

DISCOUNT—CHICAGO

Less than	¼ In. to ½ In.	¾ In. to 3 In.
2500 lb.	3.1% to 7.1%	5.8% to 9.8%
2500-5000 lb.	6.8% to 10.8%	8.8% to 12.8%

(For galvanized deduct six points from above discounts.)

FLATIRONS

NEW YORK

Net ..... $3.15 to $3.50

CHICAGO

Net ..... $3.75 to $4.20

FUSES, INCLOSED

250-Volt	Std. Pkg.	List
3-amp. to 30-amp.	100	$0.25
35-amp. to 60-amp.	100	.35
65-amp. to 100-amp.	50	.90
110-amp. to 200-amp.	25	2.00
225-amp. to 400-amp.	25	3.60
450-amp. to 600-amp.	10	5.50
600-Volt		
3-amp. to 30-amp.	100	$0.40
35-amp. to 60-amp.	100	.60
65-amp. to 100-amp.	50	1.50
110-amp. to 200-amp.	25	2.50
225-amp. to 400-amp.	25	5.50
450-amp. to 600-amp.	10	8.00

DISCOUNT—NEW YORK

Less than 1/5 std. pkg	28%
1/5 to std. pkg	38%

DISCOUNT—CHICAGO

Less than 1/5 std. pkg	28%
1/5 to std. pkg	38%

FUSE PLUGS

3-Amp. to 30-Amp.

NEW YORK

	Per 100 Net
Less than 1/5 std. pkg.	$5.75 to $6.30
1/5 to std. pkg.	4.50 to 5.25

Standard package, 500. List, $0.07.

CHICAGO

	Per 100 Net
Less than 1/5 std. pkg.	$6.25
1/5 to std. pkg.	5.25

Standard package, 500. List, $0.07.

LAMPS, MAZDA

105 to 125 Volts

Regular, clear:	Std. Pkg.	List, Each
10 to 40-watt—B	100	$0.27
60-watt—B	100	.36
100-watt—B	24	.65
75-watt—C	50	.65
100-watt—C	24	1.00
200-watt—C	24	2.00
300-watt—C	24	3.00
Round bulb, 3⅛ in., frosted:		
15-watt—G 25	50	.50
25-watt—G 25	50	.50
40-watt—G 25	50	.50
Round bulbs, 3¾ in., frosted:		
60-watt—G 30	24	.72
Round bulbs, 4⅝ in., frosted:		
100-watt—G 35	24	1.05

DISCOUNT—NEW YORK

Less than std. pkg.	Net
Std. pkg.	10%

DISCOUNT—CHICAGO

Less than std. pkg.	Net
Std. pkg.	10%

LAMP CORD

Cotton-Covered, Type C, No. 18

NEW YORK

	Per 1000 Ft. Net
Less than coil (250 ft.)	$30.00 to $35.17
Coil to 1000 ft.	21.00 to 26.73

CHICAGO

	Per 1000 Ft. Net
Less than coil (250 ft.)	$37.20 to $37.84
Coil to 1000 ft.	27.00 to 28.38

LAMP GUARDS, WIRE

Standard packages from 50 to 150.

NEW YORK

Net per 100	$18.00 to $29.00

CHICAGO

Net per 100	$20.00 to $30.00

OUTLET BOXES

Nos.	List, per 100
101—A, A1½, 4 S.C., 6200, 320	$30.00
102—B.A., 6200 S.E., 300, A.X. 1½, 4 S.	30.00
103—C.A., 9, 4 R, B 1½	25.00
106—F.A., 7, C.S. 1½, 3 R.	20.00

DISCOUNT—NEW YORK

	Black	Galvanized
Less than $10.00 list	33% to Net list	27% to List
$10.00 to $50.00 list	42%	37%

DISCOUNT—CHICAGO

	Black	Galvanized
Less than $10.00 list	40% to 43%	35% to 37%
$10.00 to $50.00 list	50% to 53%	40% to 48%

PIPE FITTINGS

DISCOUNT—NEW YORK

Less than 1/5 std. pkg.	10%
1/5 to std. pkg.	20%
Std. pkg.	30%

DISCOUNT—CHICAGO

Less than 1/5 std. pkg.	10%
1/5 to std. pkg.	20%
Std. pkg.	30%

PORCELAIN CLEATS—UNGLAZED

2 and 3 Wire

NEW YORK

	Per 1000 Net
Less than 1/5 std. pkg.	$14.00 to $20.00
1/5 to std. pkg.	13.00 to 15.00

Standard package, 2200. List per 1000, $20.

CHICAGO

	Per 1000 Net
Less than 1/5 std. pkg.	$14.00 to $18.20
1/5 to std. pkg.	13.00 to 16.90

Standard package, 2200. List per 1000, $20.

PORCELAIN KNOBS

NEW YORK

Per 1000 Net	5½ N.C.—Solid Std. Pkg. 3500	Nail-It—N.C. Std. Pkg. 4000
Less than 1/5 std. pkg.	$10.50 to $24.30	....
1/5 to std. pkg.	9.75 to 12.15	....

CHICAGO

Per 1000 Net	5½ N.C.—Solid Std. Pkg. 3500	Nail-it—N.C. Std. Pkg. 4000
Less than 1/5 std. pkg.	$10.20 to $18.00	$20.75 to $28.00
1/5 to std. pkg.	9.00 to 9.75	16.30 to 21.50

SOCKETS AND RECEPTACLES

	Std. Pk.	List
⅛-in. cap key and push sockets	500	$0.33
⅛-in. cap keyless socket	500	.30
⅛-in. cap pull socket	250	.60

DISCOUNT—NEW YORK

Less than 1/5 std. pkg.	Net list
1/5 to std. pkg.	15% to 20%

DISCOUNT—CHICAGO

Less than 1/5 std. pkg.	List
1/5 to std. pkg.	15%

SWITCHES, KNIFE

250-Volt, Front Connections, No Fuse

High Grade:	List
30-amp. S. P. S. T.	$0.80
60-amp. S. P. S. T.	1.20
100-amp. S. P. S. T.	2.25
200-amp. S. P. S. T.	3.48
300-amp. S. P. S. T.	5.34
30-amp. D. P. S. T.	1.20
60-amp. D. P. S. T.	1.78
100-amp. D. P. S. T.	3.38
200-amp. D. P. S. T.	5.20
300-amp. D. P. S. T.	8.00
30-amp. 3 P. S. T.	1.80
60-amp. 3 P. S. T.	2.68
100-amp. 3 P. S. T.	5.08
200-amp. 3 P. S. T.	7.80
300-amp. 3 P. S. T.	12.00
Low Grade:	
30-amp. S. P. S. T.	0.42
60-amp. S. P. S. T.	0.74
100-amp. S. P. S. T.	1.50
200-amp. S. P. S. T.	2.70
30-amp. D. P. S. T.	0.68
60-amp. D. P. S. T.	1.22
100-amp. D. P. S. T.	2.50
200-amp. D. P. S. T.	4.50
30-amp. 3 P. S. T.	1.02
60-amp. 3 P. S. T.	1.84
100-amp. 3 P. S. T.	3.76
200-amp. 3 P. S. T.	6.76

DISCOUNT—NEW YORK

Less than $10 list	5% to +5%
$10 to $25 list	11% to 16%
$25 to $50 list	14% to 24%

DISCOUNT—CHICAGO

Less than $10 list	+5% to 5%
$10 to $25 list	11% to 16%
$25 to $50 list	14% to 24%

SWITCHES, SNAP AND FLUSH

5-Amp. and 10-Amp., 125-Volt Snap Switches

	Std. Pkg.	List
5-amp. single-pole	250	$0.28
5-amp. single-pole, ind.	250	.32
10-amp. single-pole	100	.48
10-amp. single-pole, ind.	100	.54
5-amp., three-point	100	.56
10-amp., three-point	50	.76
10-amp., 250-volt, D. P.	100	.66

SWITCHES, SNAP AND FLUSH—Cont'd

10-Amp., 250-Volt Push-Button Switches

	Std. Pkg.	List
10-amp. single-pole	100	$0.45
10-amp. three-way	50	.70
10-amp. double-pole	50	.70

DISCOUNT—NEW YORK

Less than 1/5 std. pkg.	Net list
1/5 to std. pkg.	15%
Std. pkg.	28%

DISCOUNT—CHICAGO

Less than 1/5 std. pkg.	List to —20%
1/5 to std. pkg.	15% to list
Std. pkg.	30%

SWITCH BOXES, SECTIONAL CONDUIT

Union and Similar	List, Each
No. 155	$0.34
No. 160	.60

DISCOUNT—NEW YORK

	Black	Galvanized
Less than $2.00 list	23% to list	....
$2.00 to $10.00 list	23% to 20%	....
$10.00 to $50.00 list	23% to 30%	....

DISCOUNT—CHICAGO

	Black	Galvanized
Less than $2.00 list	25% to 40%	20% to 30%
$2.00 to $10.00 list	25% to 50%	15% to 40%
$10.00 to $50.00 list	25% to 64%	25% to 52%

TOASTERS, UPRIGHT

NEW YORK

Net price	$3.10 to $3.50

CHICAGO

Net price	$2.80 to $3.50

WIRE, ANNUNCIATOR

DISCOUNT—NEW YORK

No. 18, less than full spools	52%
No. 18, full spools	48%

CHICAGO

	Per Lb. Net
No. 18, less than full spools	$0.565 to $0.6885
No. 18, full spools	0.495 to 0.55

WIRE, RUBBER-COVERED, N. C.

Solid-Conductor, Single-Braid

NEW YORK

No.	Price per 1000 Ft. Net: Less than 500 Ft.	500 to 1000 Ft.	1000 to 5000 Ft.
14	$15.00-18.00	$12.00-14.50	$11.50-12.50
12	21.06-27.05	18.96-22.85	18.01-20.95
10	29.60-39.27	26.64-33.66	25.31
8	42.40-51.44	38.16-48.42	36.25
6	72.19-89.57	64.98-76.80	61.73

CHICAGO

No.	Price per 1000 Ft. Net: Less than 500 Ft.	500 to 1000 Ft.	1000 to 5000 Ft.
14	$18.00	$16.00	$14.00
12	25.92-29.89	21.96-25.62	19.44-23.48
10	36.48-42.28	30.84-35.58	27.36-33.22
8	43.80-60.13	40.15-51.54	35.77-47.25
6	69.24-82.72	63.47-75.73	56.55-61.20

WIRE, WEATHER-PROOF

Solid-Conductor, Triple-Braid, Sizes 4/0 to 8 Inc.

NEW YORK

	Per 100 Lb. Net
Less than 25 lb.	$40.25 to $45.00
25 to 50 lb.	39.25 to 42.00
50 to 100 lb.	$38.00

CHICAGO

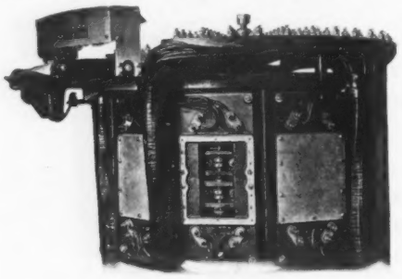
	Per 100 Lb. Net
Less than 25 lb.	$42.35 to $45.50
25 to 50 lb.	41.35 to 44.50
50 to 100 lb.	40.35 to 43.50

NEW APPARATUS AND APPLIANCES

A Record of Latest Developments and Improvements in Manufacturers' Products Used in the Electrical Field

Largest Graphic Meter in the World

A 250,000-kw. totalizing graphic meter has been built by the Esterline Company of Indianapolis, Ind., and installed in the Keokuk plant of the Mississippi River Power Company. To meter the output of the thirty three-phase generators used in this plant required the use of thirty polyphase meter elements, each made up of two single-phase units. In carrying out the design of this instrument the desirability of using the same general design in other instruments was borne in mind, with the result that the supporting frame was made up of three sections, each carrying ten polyphase meter elements, thereby making it possible to construct a similar instrument of ten elements or any multiple of ten up to fifty. The instrument is designed so as to be self-contained, without the use of an external case, and is arranged so as to enable the removal and calibration of any individual meter element without putting the instrument out of operation.



ONE SECTION OF A 250,000-KW. TOTALIZING GRAPHIC METER

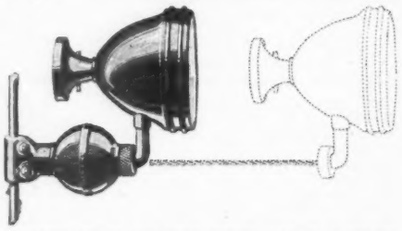
The induction type of meter element was adopted, after having devised an element capable of being calibrated mechanically for torque without affecting the correction for power factor. The moving element consists of six aluminum vanes, all mounted on a single staff, supported in such a manner as completely to eliminate friction. The use of this type of element entirely eliminated moving connections or contacts and made possible a high ratio of torque to pen friction.

All connections are carried to the top of the instrument to a circular terminal board carrying 240 binding posts, four being used for each single-phase meter element. The actual width of chart is 12.5 in. (31.8 cm.). The charts used are printed in twelve-hour sections and fed at the rate of 3 in. (7.6 cm.) per hour over two rollers, one of which carries pins for driving the paper and is rotated by means of a solenoid-operated ratchet connected in the electric clock system of the plant. The indicating scale which faces the system operator's desk is illuminated and graduated to the same range as the chart.

With an instrument of this type it is possible to totalize the output of a station of any capacity or a number of stations or systems, regardless of differences in frequencies, voltage and whether or not they are in synchronism, and instruments of the same type can be built for any number of circuits from five to fifty.

A Three-Service Lamp for Autos

An electric automobile lamp which may be used as a spotlamp, trouble lamp or floodlamp for camps and picnics is being made by the Anderson Electric Specialty Company of Chicago, Ill. The lamp and bracket are finished in black enamel. A 21-cp. nitrogen-filled tungsten lamp is used in connection with a silvered parabolic reflector. An adjustable cord reel which operates like a curtain roller is located in the ball casing just back of the lamp. Unscrewing the knurled nut permits the lamp to be withdrawn and used as a portable. Control is afforded by a positive "on and off" switch mounted at the back of the lamp.



A CORD REEL MAKES THIS LAMP A FLEXIBLE TROUBLE LAMP

Universal-Type Sewing Machine Motor

The Pittsburgh Electric Specialties Company of Pittsburgh, Pa., has placed on the market a universal-type sewing-machine motor of simple design. It fits any make or style of machine and is attached without brackets, pulleys, screws or clamp. All that is necessary is to place it in position so that its pulley engages the wheel of the machine and it is ready for work. It is so balanced that it remains in position without being fastened. The speed is regulated and the motor started and stopped by a foot control on the floor.

Elevator Brake Magnet

An elevator brake magnet, designed for use with the parts regularly furnished by the elevator builder and which may be used for elevator motors operating on 220, 440 and 550-volt, 25-cycle to 60-cycle, two-phase and three-phase circuits, is shown in the accompanying illustration. It is installed by mounting it directly over the brake wheel, the base being bolted against the machined gear case.

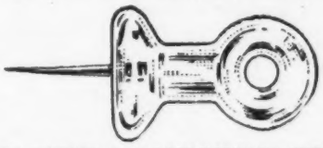
The operation of the magnet is as follows: When no current is flowing through the motor the brakes are set, being held by a spring. When the motor is started a portion of the current passes through the shunt magnet coils, energizing them and pulling down the brake armature. The travel of this armature, which is about ¼ in. (6.4 mm.) at the point furthest from the bearing, gives a horizontal motion of 1/16 in. (1.6 mm.) to each of the lower ends of the bell cranks, compressing the springs and releasing the brake. When the energy supply is interrupted the armature is released and the brake applied by the springs. The recoil of the magnet armature is taken up by buffer springs, which may be adjusted to the proper compression. The pull of the magnet is 150 lb. (68 kg.) on the lower ends of each of the bell cranks, making a total of 300 lb. (136 kg.) compression available.

MAGNET MOUNTED DIRECTLY OVER BRAKE WHEEL

The magnet which is described above is a product of the Westinghouse Electric & Manufacturing Company of East Pittsburgh, Pa.

Glass Eyelets for Temporary Wiring

Glass push pins provided with an eyelet for use in temporary low-voltage wiring are being made by the Moore



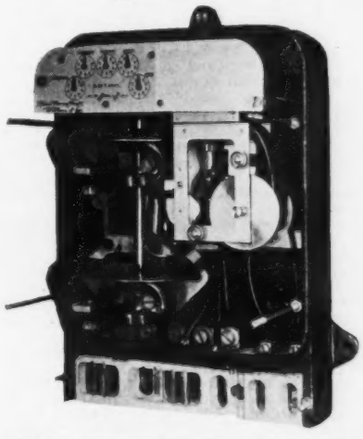
GLASS EYELET FOR LOW-VOLTAGE WIRING

Push Pin Company of Wayne Junction, Philadelphia, Pa. The pins are easily attached to woodwork or walls, and it is pointed out by the maker that they are particularly useful for amateur battery work where small wires are to be run about the house.

Printing Watt-hour Meter That Gives Peaks

An effective method of checking peak loads has been devised by the British Westinghouse Electric & Manufacturing Company, Ltd., Manchester, England. This firm makes several types of maximum-demand meters and has recently developed a printing-type meter equipped with a chart whereon are printed the total units of energy consumed over predetermined periods. The time at which the "peak" loads occur is also recorded.

As distinct from the usual forms of the maximum-demand meter, there is no periodical resetting, the total units registering upon an ordinary dial, another set of wheels being engaged so as to operate the printing mechanism. This part of the meter has three cyclometer dials with specially raised figures, a corresponding number of plungers, actuated by an electromagnet, serving to make the impressions. In consequence of this arrangement the chart is im-



METER FOR CHECKING PEAK LOADS

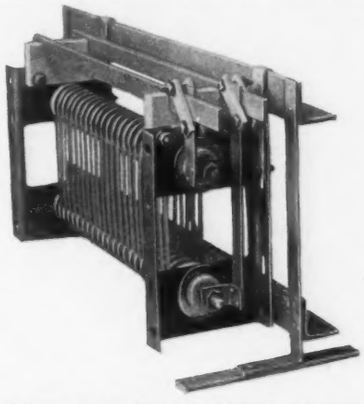
printed at intervals for which the device has been set.

Each roll or chart is controlled by a time switch and will last from ten to twenty days, depending upon the time intervals. The peak loads can be obtained by finding the difference between consecutive readings and multiplying by the number of imprints made per hour. The time intervals are standardized at fifteen minutes to two hours, but other settings can be obtained if required. A simple spool mechanism permits rapid changing of the charts, obviating interruption.

Industrial Oven Heater

Oven heaters designed especially for use in enameling or japanning ovens, but which may be used in a large variety of applications where ovens are employed for a baking or drying process, have been developed by the Westinghouse Electric & Manufacturing Company of East Pittsburgh, Pa.

The heating element consists of a ribbon wound on a number of fire-clay bushings assembled on two steel tie rods between two pressed-steel end plates. The ends of the ribbon are secured to drop-forged steel terminals which are clamped to the steel tie rods,



HEATER FOR USE IN JAPANNING OVEN

the rods thereby becoming the terminals for the heaters. These rods are insulated from the end frames through which they pass, and the ends are threaded for bolting on the connectors.

Cold-rolled steel busbars are recommended and may be mounted directly above the heater on insulators bolted directly to the end frames. Hooks are used for hanging the heaters on to the usual supporting steel work, which may be flat iron, angle or channel iron or pipe work. Protecting screens may be attached directly to the end plates.

Renewable Fuse with Telescoping Element

Cartridge fuses with renewable elements that telescope into fiber shells are being made by the Arrow Fuse & Manufacturing Company of Milwaukee, Wis. The casing, the manufacturer claims, will last indefinitely and carries bolted contacts. A fire-retarding powder filler is used which, besides eliminating noise from explosion, is designed to prevent blackening of the contacts. The renewal operation involves the loosening of only three screws. The design of the shells and elements is such that only the proper cartridge can be used in connection with a fuse element.

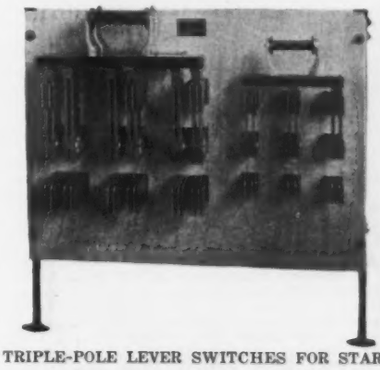
Electric Warmer for Fudge Sauce

An electric warming device designed for preparing and serving hot fudge sauce at soda fountains and candy stores has been developed by Landers, Frary & Clark of New Britain, Conn. Two heats are provided, one with 420 watts demand for quick work and one with 55 watts demand to maintain a proper serving temperature throughout the day. The appliance is made in 3-pint and 6-pint (1.4-l. and 2.8-l.) sizes and is equipped with a patented safety fuse plug for protection against possible injury in case the water pan is allowed to boil dry.

Split-Lever Starting Switch

The General Electric Company of Schenectady, N. Y., has devised a method of reducing the effort necessary to operate large lever switches used for starting large synchronous converters from the alternating-current side in conjunction with auto-transformers. To illustrate the switch arrangement by which this result was achieved, reference will be made to the two accompanying triple-pole switches for starting a six-phase converter. The switch on the left consists of two switches placed side by side, so as to serve as a single switch when thrown into the lower position. There are two cross-bars with separate handles. One-half the blades forming each pole are fastened to one of the cross-bars, while the other half are attached to the other cross-bar.

When used to start a synchronous converter the blades are temporarily thrown into the upper contacts, which are connected to the two-thirds voltage. These contacts are arranged to engage with only one set of blades—those which are attached to the outer cross-bar, or, in other words, those that would be moved first in throwing the switch into the lower position. This portion of the switch, comprising half the blade area, carries the current



TRIPLE-POLE LEVER SWITCHES FOR STARTING SIX-PHASE CONVERTER

until the remaining half of the switch can be thrown to the lower position. Switches of this type have been built up to 5000 amp. rating. They are easily operated and avoid the alternative, which is the installation of large solenoid-operated circuit breakers.

Trade Publications

BELLS.—Edwards & Company, Inc., 140th and Exterior Streets, New York City, is distributing a leaflet descriptive of its iron box bells and buzzers.

PHOTOGRAPHY.—Bulletin No. 78 of the Cooper Hewitt Electric Company, Hoboken, N. J., is a complete catalog of electric lamps and accessories for photographic processes.

MAGNETOS AND LIGHTING GENERATORS.—The Norma Company of America, New York City, is distributing folders relative to ball bearings in magnetos and lighting generators.

SIGNAL SYSTEM.—The Bryant Electric Company, Bridgeport, Conn., has a book on silent-call signal systems for hospitals. This describes the apparatus and illustrates its uses, wiring diagrams being given.

ELECTRIC HOISTS.—Bulletin No. 48,-923, descriptive of electric hoists for use for from 1 ton to 6 tons, has been prepared by the Sprague Electric Works of the General Electric Company, New York City.

STORAGE BATTERIES.—The Titan Storage Battery Company, Newark, N. J., has issued a book on storage batteries. Storage-battery parts are described and the elementary theory and performance are discussed.

REFLECTORS.—X-ray reflectors for direct, store-window, showcase and flood lighting are illustrated and described in catalog No. 20, recently prepared by the National X-Ray Reflector Company of Chicago and New York.

METERS.—Bulletin No. 46 of the Sangamo Electric Company, Springfield, Ill., tells of the construction and performance of alternating-current watt-hour meters. Price lists and table of train ratios and disk constants are given.

LOW-VOLTAGE TRANSFORMERS.—The Thordarson Electric Manufacturing Company, 501 South Jefferson Street, Chicago, has prepared leaflet No. 70-A, descriptive of its transformers, jump spark coils, make-and-break coils and low-voltage transformers for side lighting and special work. This leaflet also describes this company's wireless transformers.

ELECTRICAL APPARATUS.—The Wagner Electric Manufacturing Company of St. Louis is distributing a booklet in which is reviewed the history of the foremost of those who have made the present age of electricity possible. This booklet also brings to the reader's attention some of the results of the pioneer work which this company has done and its contributions to the art.

MANUAL OF SALES HELPS.—The Western Electric Company of New York City is distributing a manual of samples and reproductions of its complete line of free selling helps, designed for the use of the sellers of electrical appliances. These selling helps are typical of Western Electric educational publicity, illustrating a policy that is different from the advertising of most manufacturers and unique among jobbers. In this publicity the main theme is to sell the idea "Do it electrically." These helps include "Sewing Machines," "A Complete Local Advertising Campaign," "New Electric Iron," "Washing and Wringing Machines," "Fans," "Vacuum Cleaners," "Ranges," "Dish Washers," "Vibrators," "Sewing Machine Motors and Attachments," and "Heating Pads." Newspaper printing plates, lantern slides, folders, display cards, billheads, stickers, window displays and magazine advertisements are shown. A copy of this manual may be had upon request.

MAGNETIC SEPARATOR PULLEYS used to remove magnetic content from nonmagnetic bulk material and to protect grinding, crushing and pulverizing machinery are described in booklet S, a new sixteen-page pamphlet just published by the Cutler-Hammer Manufacturing Company of Milwaukee. This booklet lists thirty-five distinct industries where the pulleys are now in use and describes the functions of the pulleys in each. In cement mills, coal mines, cocoanut-butter factories, cake works, feed plants, fertilizer foundries, light and power companies, linoleum factories, paper mills, pulp mills, railroad shops, railroad systems, rubber-reclamation plants and smelter copper companies the manufacturer states that the pulleys are used principally to protect grinding, crushing and pulverizing machinery from iron and steel pieces which might damage it. On the other hand, it is stated that aluminum casting plants, automobile parts plants, bearing manufacturers, blast furnaces, brass foundries, brass mills, city refuse disposal plants, fiber plants, fireclay and porcelain plants, glass products plants, gold mines, grease-manufacturing plants, gypsum mills, starch-refining plants, steel plants, sugar refineries, tea and spice importing houses and terra-cotta plants use C-H magnetic separator pulleys in refining their products through the removal of iron and steel foreign material. The booklet also contains excerpts from letters from twenty-three users of the pulleys engaged in some of the industries mentioned above. Illustrations showing actual installations in various industries are included.

Trade Notes

FRANK LEWIS BIGELOW, president of the Bigelow Company, New Haven, Conn., died on June 20 in the fifty-fifth year of his age.

S. KAHN, 1751 West Thirty-seventh Street, Chicago, advises that the business of K. McLennan & Company, manufacturer of Gale's commutator compound, was turned over to him on Nov. 1 last.

THE ESTERLINE COMPANY of Indianapolis, Ind., has appointed V. W. Shear & Company of Cleveland and Akron, Ohio, district sales agents for graphic recording meters in the northern Ohio territory.

JOSEPH V. KUNZE, vice-president of the Pelton Water Wheel Company and manager of its Atlantic department during the last twenty-four years, died at his home in Brooklyn, N. Y., on June 27, after a brief illness.

THE AUTOMATIC ELECTRIC WASHER COMPANY, Newton, Iowa, announces that it has completed and is now occupying its new factory. The company has gone to considerable expense to install efficient and labor-saving machinery in its new plant.

THE DRIVER-HARRIS COMPANY, Harrison, N. J., announces that all departments were shut down for one week beginning June 30. This action was taken to provide for necessary repairs in equipment and to give employees an opportunity to recuperate after a long, hard drive. During the week the plant was shut down a skeleton organization only was maintained by the company.

THE CUBAN MARKET.—A report on the market for construction materials and machinery in Cuba has been written by the Bureau of Foreign and Domestic Commerce for the firms that are interested in this market and want to know how to go about getting business there. Copies may be procured from the Bureau of Foreign and Domestic Commerce, Washington, D. C., for a nominal sum.

THE SHEPHERD-RUST COMPANY of Wilkes-Barre, Pa., recently formed for general electrical construction work, including the manufacture of electrical fixtures, etc., with a capital stock of $75,000, will take over the business of Shepherd & Rust, which was a general electrical construction and jobbing house for more than twenty-one years. George Shepherd and Harold N. Rust, the principal incorporators, will direct the policy of the new corporation.

THE INDUSTRIAL ELECTRIC FURNACE COMPANY, organized under the laws of the State of Indiana, has acquired the business of the Snyder Electric Furnace Company and the Snyder patents and designs of electric funaces and processes. The directors of the new company are Charles B. Sommers, Stoughton A. Fletcher and Charles B. Fletcher of Indianapolis, and F. Von Schlegell and F. T. Snyder of Chicago. The business organization is new, and the company will start with a large engineering force. It will take up the manufacture of electric furnaces for steel work, and will enlarge the plant at Clearing, Ill., both for electro-metallurgical developments and for the commercial production of electric-furnace products. While no definite announcement of furnace types has yet been made, the company has let it be known that it will soon be in the market with an electric-furnace unit which will combine the desirable features of a three-phase electrical load and the further metallurgical advantages of a single electrode furnace. Mr. Snyder, who will be interested in and associated with the new company as engineer and metallurgist, has had many years of experience in the electric-furnace field. The executive officers of the company will be F. Von Schlegell and Charles B. Fletcher. The offices of the new company will be at 53 West Jackson Boulevard, Chicago.

New Incorporations

THE BRADY TOWNSHIP ELECTRIC COMPANY of Scranton, Pa., has been incorporated with a capital stock of $5,000. John P. Rawson is treasurer.

THE BANKS TOWNSHIP ELECTRIC COMPANY of Scranton, Pa., has been chartered with a capital stock of $5,000. John P. Rawson is treasurer.

THE HEREFORD TOWNSHIP ELECTRIC COMPANY of Wyomissing, Pa., has been chartered with a capital stock of $5,000. A. L. Hart is treasurer.

THE MILLER LIGHT, HEAT & POWER COMPANY of Philadelphia, Pa., has been incorporated with a capital stock of $5,000. John E. Zimmerman is treasurer.

THE ONEIDA LIGHT, HEAT & POWER COMPANY of Philadelphia, Pa., has been chartered with a capital stock of $5,000. John E. Zimmerman is treasurer.

THE PERRY TOWNSHIP ELECTRIC COMPANY of Foxburg, Pa., has been incorporated with a capital stock of $5,000. C. M. Hart is one of the incorporators.

THE NEW SEBREE LIGHT & POWER COMPANY of Sebree, Ohio, has been chartered with a capital stock of $8,100 by Henry Powell, J. J. Korb and D. M. McMullen.

THE PROFILE FALLS POWER COMPANY of Portland, Me., has been chartered with a capital stock of $200,000. Sherman I. Gould is president and Charles H. Tolman is treasurer and clerk.

THE MERRIMACK POWER COMPANY of Portland, Me., has been incorporated with a capital stock of $200,000. The directors are: Sherman I. Gould, president; R. D. Little of Cape Elizabeth, and Embert L. Jones of Gorham.

THE CENTRAL BATTERY CORPORATION of New York, N. Y., has been incorporated with a capital stock of $600,000 by H. S. Johannsen, P. Platou and J. B. Wardwell. The company proposes to manufacture electric batteries.

THE MET-STO-BAT METALLIC STORAGE BATTERY COMPANY of St. Louis, Mo., has been incorporated by A. I. Jacob, John K. Sterling and others. The company is capitalized at $50,000 and proposes to manufacture storage batteries.

THE TRELECTRIC MACHINERY COMPANY of Cleveland, Ohio, has been organized by William T. Tregonning, J. A. Boyden, H. N. Pettibone and others. The company is capitalized at $25,000 and proposes to manufacture electrical appliances.

THE PETERSBURG (Mich.) ELECTRIC LIGHT & POWER COMPANY has been incorporated to generate and distribute electricity for lamps and motors in Petersburg. The incorporators are: William Schroeder, W. L. McArron and G. Guggenbihler.

THE KEOUGH AUTOMOBILE DIRECTION INDUCTOR COMPANY of Mansfield, Ohio, has been chartered with a capital stock of $15,000 by Z. Keough and others. The company proposes to establish a plant to manufacture an electrically operated device.

THE PRIMO LIGHT & MANUFACTURING COMPANY of St. Louis, Mo., has been incorporated with a capital stock of $50,000 by Henry C. Finck, Leo J. Bayer and Henry H. Oberschelp. The company proposes to manufacture heating, lighting and power devices.

THE FAYETTEVILE (TENN.) ELECTRIC POWER & LIGHT COMPANY has been incorporated by H. Knox Bryson, W. J. Bunn, William M. Smith, Hugh D. Smith and J. A. Moores. The company is capitalized at $60,000 and proposes to generate and distribute electricity for lamps and motors.

THE LITTLE GIANT HEATING & LIGHTING COMPANY of Los Angeles, Cal., has been chartered with a capital stock of $100,000 to manufacture heating and lighting systems. The incorporators are: A. L. Davidson, 712 H. W. Hellman Building; D. S. Collins, 4942 Lynn Street, and S. V. Halstead, 629 South Flower Street, Los Angeles.

THE CONEWANGO TOWNSHIP ELECTRIC COMPANY, the Glade Township Electric Company, the Meadow Township Electric Company and the Pleasant Township Electric Company have been granted charters to operate in Crawford County. Each company is capitalized at $5,000. The headquarters of the companies will be located at Scranton. John P. Rawson is treasurer.

New England States

BANGOR, ME.—The Bangor Railway & Electric Company is planning to extend its transmission line from Somerville to Southwest Harbor, a distance of 12 miles. The company will also erect a line from Milford to Lincoln, a distance of 33 miles.

PORTSMOUTH, N. H.—Improvements involving an expenditure of over $200,000 will be made to the electric-light, power and heating plant at the Portsmouth navy yard. New equipment and other apparatus will be installed.

BOSTON, MASS.—Bids will be received by the board of trustees of the Consumptives' Hospital Department, 1001 City Hall Annex, Boston, until July 23, for furnishing material and installing complete electric wiring, etc., for Ward O, on hospital grounds, River Street, Mattapan, Boston. Proposal blanks may be obtained at the office of Hollis, French & Allan Hubbard, 88 Pearl Street, Boston.

BROCKTON, MASS.—Bids will be received by the trustees of the Brockton Hospital, Brockton, until July 13 for installing and completing electric wiring in the new hospital building at the hospital grounds, Centre Street. Plans and form of proposal may be obtained at the office of Wells & Dana, architects, 29 Central Street, Boston, Mass., upon deposit of $15. Loring B. Packard, M. D., is superintendent.

LOWELL, MASS.—The Lowell Electric Light Corporation has applied for permission to lay conduits in Thorndyke and Appleton Streets.

SALEM, MASS.—The Salem Electric Light Company is planning to erect a fireproof building in Peabody Street, to cost $40,000, to be used for a testing department, stock rooms and garage.

SHELBURNE FALLS, MASS.—According to specifications laid before the State Board of Gas and Electric Light Commissioners the New England Power Company contemplates the construction of a hydroelectric power plant on the Deerfield River at Readsboro, Vt., involving an expenditure of about $7,000,000. The proposed work will include the construction of an earthen dam, nearly 200 ft. high, which will create a storage basin covering 3000 acres of land. From this dam a tunnel is to be bored through the mountain a distance of 14,000 ft. to a point known as Davis Bridge, where a power house is to be erected, equipped to generate 36,000 hp. The proposed plant will supply additional energy to manufacturing plants in Worcester, Hampshire, Hampden and Bristol Counties.

SPRINGFIELD, MASS.—George W. Atkinson of Washington, D. C., has been appointed electrical engineer at the United States Armory at Springfield. He will have charge of the installation of a complete new power plant for the Hill shops, for which Congress recently appropriated $90,000.

NEWPORT, R. I.—Bids will be received at the Bureau of Yards and Docks, Navy Department, Washington, D. C., until July 30, for construction of primer filling house, including electrical work and electric elevator, at the naval torpedo station, Narragansett Bay, Newport, R. I. Specifications, etc., may be obtained on application to the above bureau or to the commandant of the naval station named.

NEW HAVEN, CONN.—Bids will soon be submitted for the large power and heating plant for the Yale University to be erected on Ashmun Street to furnish power for the entire university, grounds and buildings. The tunnel system now being built by the Sperry Engineering Company will lead to the proposed plant.

NEW HAVEN, CONN.—Application has been made to the Public Utilities Commission by the Rocky River Power Company, the Housatonic Power Company of New Haven, the United Electric Light & Water Company of Waterbury and the Seymour (Conn.) Electric Light Company for permission to consolidate the above companies under the name of the Rocky River Power Company. The Rocky River company is to pay $6,000,000 for the holdings of the other three companies. The new company, it is understood, proposes to construct additional hydroelectric plants on the Housatonic River and a large steam generating plant at some point at tidewater to insure uninterrupted service.

Middle Atlantic States

BINGHAMTON, N. Y.—The Binghamton Light, Heat & Power Company has petitioned the Public Service Commission for permission to issue $407,000 in bonds and $174,100 in capital stock, the proceeds to be used for expansion to the service department, line extension, equipment, etc.

Construction

News of Projects, Plans, Bids and Contracts. Notes on Work Under Way

BROOKLYN, N. Y.—Plans have been filed by the New York Telephone Company for a three-story telephone exchange and office building to be erected at Liberty Avenue and Milford Street, to cost about $125,000.

BROOKLYN, N. Y.—Bids will be received by the State Hospital Commission, Capitol, Albany, N. Y., until July 25, for construction work and refrigeration equipment for storehouse and cold-storage building at the Brooklyn State Hospital, Brooklyn. Drawings and specifications, Nos. 2619 and 2754, may be consulted at the Brooklyn State Hospital, the New York office of the Department of Architecture, room 1224 Woolworth Building, and at the Department of Architecture, Capitol, Albany. Lewis F. Pilcher is State architect.

JORDAN, N. Y.—The capital stock of the Jordan Electric Light & Power Company has been increased from $10,000 to $25,000, the proceeds to be used for extensions and improvements.

LOCKPORT, N. Y.—The United Paper Board Company of Lockport is contemplating the construction of a power house, 100 ft. by 100 ft., one story. Sidney Mitchell, 171 Madison Avenue, New York City, is president.

NEW YORK, N. Y.—J. T. Butler, Room 714, 38 Park Row, New York City, is reported to be in the market for mining equipment and electric apparatus, including four electric cutters, a 500-hp. compound engine, two 300-kw., 250-volt, direct-current generators; marble switchboard complete; steam and water piping at power house; waterworks system for miners' houses, etc.; two electric 15-ton haulage motors; four electric motors, 50 hp. each; equipping outside of mine with electricity; wiring and 1000 incandescent lamps; portable sawmill and machinery for same, four sets of drills, tools, general equipment, etc.

POUGHKEEPSIE, N. Y.—The Central Hudson Gas & Electric Company has purchased the old carpet mill, the mill houses and water rights at Rifton.

RICHMOND, N. Y.—The Staten Island Shipbuilding Company has taken out a permit for the erection of a brick power house, 40 ft. by 80 ft., to be erected on Richmond Terrace, near Andros Avenue, at a cost of about $16,500. Lockwood, Greene & Company of Boston, Mass., are architects.

SYRACUSE, N. Y.—A committee has been appointed by John R. Clancy, president of the Chamber of Commerce, to look into the feasibility of establishing a municipal electric-lighting plant to furnish electricity for lighting the streets and public buildings. The contract with the Syracuse Lighting Company expires in July, 1918.

SYRACUSE, N. Y.—Plans are being prepared by Captains George O. Hubbard and David Caldwell, quartermaster corps, in charge of camp construction, for the installation of an electric-lighting system at the open camp on the Van Vleck Road. The cost of the work, including extension of electric transmission lines, is estimated at about $20,000. The cost of extending the main power lines of the Syracuse Lighting Company is placed at about $1,700.

UTICA, N. Y.—The Utica Gas & Electric Company, it is reported, has awarded contract for the erection of a boiler house on Washington Street.

BAYONNE, N. J.—The Public Service Electric Company has applied for permission to construct a new underground conduit system from Twenty-second Street to the plant of the National Sulphur Company at Constable Hook to supply energy to operate the plant of the latter company there.

HIGHTSTOWN, N. J.—The Public Utility Commissioners have granted the Electric Light & Power Company of Hightstown permission to issue $35,000 in bonds for extension and betterments to its system.

HOPEWELL, N. J.—The Board of Public Utility Commissioners has granted the Eureka Power Company, a subsidiary of the New Jersey & Pennsylvania Traction Company of Trenton, permission to erect a new line on the River Road from Hopewell-Ewing Township boundary to Hunterdon County, and from Washington Crossing to Titusville and Pennington.

NEWARK, N. J.—The City Council has authorized the advertising for bids for the installation of an improved lighting system in Center Market.

NEWARK, N. J.—The Foundation Company of New York has entered into an agreement with the Public Service Electric Company for energy to operate its new shipbuilding works on the Newark Meadows. A transmission line will be erected to the works.

PERTH AMBOY, N. J.—Bonds to the amount of $50,000 have been sold. The proceeds are to be used for installation of the proposed commercial distribution system for the municipal power plant. Runyon & Carey, 843 Broad Street, Newark, are engineers.

STRATFORD, N. J.—Extensions and improvements to the street-lighting system, including reconstruction in many sections, are under consideration by the City Commissioners in connection with a five-year light contract to be awarded.

JOHNSTOWN, PA.—The Citizens' Light, Heat & Power Company is contemplating the installation of an ornamental street-lighting system, maintained by underground wires, in the business district.

LANCASTER, PA.—Plans are being prepared for a new power house for the Lancaster General Hospital. The heating system will be completely overhauled. A 100-ft. smokestack will be erected in connection with the new plant.

MAHANOY CITY, PA.—The Schuylkill Gas & Electric Company has entered into a contract with the P. & R. C. & I. Company to furnish energy for the North Mahanoy and Draper collieries.

MIDDLETOWN, PA.—The installation of an ornamental lighting system in the public square at the junction of Union and Main Streets, is under consideration.

PHILADELPHIA, PA.—The Philadelphia Rubber Works is considering erecting a transformer station at its factory on Reed Street.

PHILADELPHIA, PA.—F. A. Poth & Sons are contemplating the construction of a new boiler plant, 44 ft. by 50 ft., at their factory at Thirty-first and Jefferson Streets.

PHILADELPHIA, PA.—The Electric Storage Battery Company, Nineteenth Street and Allegheny Avenue, Philadelphia, is planning to erect a two-story addition to its plant.

PHILADELPHIA, PA.—To increase the output of the city water plant, new impeller wheels will be installed at the Torresdale station. The Bureau of Water has charge of the work.

PHILADELPHIA, PA.—The City Council has authorized the construction of a new power plant at Pine and Thirty-fourth Streets for municipal service. Plans are being prepared by Philip H. Johnson, architect.

PHILADELPHIA, PA.—Contract has been awarded by the Philadelphia Drying Machine Company, Westmoreland Avenue and Stokley Street, Philadelphia, for the construction of a one-story shop and addition to power plant, to cost about $20,000.

PHILADELPHIA, PA.—Bids will be received at the Bureau of Yards and Docks, Navy Department, Washington, D. C., until July 27, for the construction of three one and two-story brick and reinforced concrete shop additions, including electric work, heating, etc., at the Frankford Arsenal, Philadelphia.

PITTSBURGH, PA.—Plans have been filed by the National Biscuit Company for the erection of a new baking plant at Penn Avenue and Lambert Street, to cost about $600,000. The construction of a power plant, to cost about $25,000, is included in the project.

WILMINGTON, DEL.—The Diamond State Telephone Company is planning to erect a new line from Cape Delaware to Cape Charles, Va., and also for the installation of new cable lines at New Castle to replace the present single-strand lines. Application has been made by the company to the Council for permission to do the work.

BALTIMORE, MD.—The contract for electrical work and mechanical equipment at School No. 47 has been awarded to Riggs, Distler & Stringer, 23 Light Street, Baltimore, at $41,724.

CECILTON, MD.—A company has been organized to construct and operate an electric-light plant in Cecilton. Contract, it is understood, has been awarded for construction of plant. The officers of the company are: William H. Alderson, president; William H. Brown, secretary, and E. S. Short, treasurer.

TOWSON, MD.—The Black & Decker Manufacturing Company contemplates the erection of a power house at its new works to be built at Towson for manufacturing air compressors, electric drills, etc. R. C. Thomas is chief engineer.

BURNSVILE, W. VA.—The Pittsburgh & West Virginia Oil Company is planning to install new engines, boilers and other operating machinery at its different pumping stations.

CHARLESTON, W. VA.—Bids will be received at the Bureau of Yards and Docks, Navy Department, Washington, D. C., until July 16, for construction of four buildings for machine shop, foundry and forge shop, heat-treatment plant and lavatory and locker rooms, including electric work, heating, etc., at the United States naval projectile plant at Charleston. Specifications No. 2454 and drawings can be obtained on application to the above bureau.

FAIRMONT, W. VA.—Surveys have been made and rights of way secured by the Monongahela Valley Traction Company for the erection of 30 miles of electric transmission lines to furnish energy to various coal mines. A line (20 miles long) will extend from Ocean Mine, near Clarksburg, via Bridgeport, Rosemont, Flemington, Astor and to Galloway, to supply the Simpson Creek Coal Company and other companies operating in that section; also a line from Riversville toward Morgantown to supply the Lehigh mine operated by the Jamison Coal & Coke Company and the mines of the South Pittsburgh Coal Company and the Antler Coal Company, 10 miles long. F. A. Webster is superintendent of construction.

PETERSBURG, VA.—Work will begin at once by the Petersburg & Wheeling Railway Company to double-track its railway to the camp site at Lakemont.

WASHINGTON, D. C.—The War Department is planning for the immediate installation of an electric-lighting system at the new military camp at Annapolis Junction.

WASHINGTON, D. C.—Bids will be received at the Bureau of Yards and Docks, Navy Department, Washington, D. C., until July 23, for two coal-handling plants to be installed at the navy yards at Philadelphia, Pa., and Norfolk, Va.

WASHINGTON, D. C.—The Public Utilities Commission has instructed the Potomac Electric Company to extend its conduit system from its present terminus at the intersection of Champlain Avenue and Kalorama Road northward to connect with the existing conduits on Champlain Avenue, south of Euclid Street.

North Central States

WAHJAMEGA, MICH.—Bids will be received by the Michigan Farm Colony for Epileptics (a State institution), Wahjamega, for construction of three buildings as follows: (1) Cottage No. 6 for inmates; (2) addition to present power house and laundry building; (3) a combination store, bakery and refrigerator building. Plans and specifications may be obtained on application to R. L. Dixon, medical superintendent, Wahjamega, and at the office of E. E. Dunlap, architect, 708-709 Hammond Building, Detroit, Mich.

CAMDEN, OHIO.—The local electric-light plant, it is reported, has been purchased by S. P. Hall and others of Angola, Ind.

CLEVELAND, OHIO.—A permit has been taken out by the American Steel & Wire Company for the construction of a coal storage and coal-handling plant and a mill building.

COLUMBUS, OHIO.—The City Council has passed an emergency ordinance authorizing an issue of $65,000 in bonds for the purpose of rehabilitating the entire street-lighting system. Work will begin on replacing the arc lamps now in use with nitrogen lamps as soon as funds are available.

COLUMBUS, OHIO.—The supplemental estimate prepared by Herman Gamper, city engineer, states that only 700 additional lamps would be required to take care of the city needs instead of 1675 additional lamps recommended in the former report. To take care of the present lighting system 29 circuits are in service and with the new system, including the additional 700 lamps, but 23 circuits would be required. It is proposed to replace the arc lamps now in use with nitrogen lamps. The cost is estimated at $65,000.

EAST LIVERPOOL, OHIO.—The City Council is considering a plan, recommended by the Chamber of Commerce, for lighting the streets of the business section of the city.

MASSILLON, OHIO.—The Massillon Electric & Gas Company has closed a contract with the Central Steel Company of Massillon for 14,000 kw. The contract calls for delivery of 6000 kw. by Aug. 1 and the remaining 8000 kw. by Jan. 1, 1918. Other contracts have been made for 4000 kw. additional in the next six months. The company is installing an additional 4500-kw. unit at its plant.

MAYNARD, OHIO.—An underground substation is being installed at the Lydia Mine of the Pursglove-Maher Coal Company. Energy to operate the plant will be supplied by the Sunnyside Electric Company.

NEWARK, OHIO.—Work has begun on the erection of the addition to the local power station of the Ohio Light & Power Company on East Street, which will more than double the present output of the plant. A new 12,500-kw. turbo-generator and 2500 hp. in boilers will be installed. The plans provide for a new smokestack, the installation of a traveling crane, equipping boilers with automatic stokers and the boiler room with coal bunkers. The company is now erecting a transmission line between Newark and Tiffin, a distance of more than 100 miles. The line is completed to Shelby.

REPUBLIC, OHIO.—The Village Council has awarded the contract for erecting 4 miles of electric transmission line from the Tiffin-Shelby line of the Ohio Light & Power Company to Republic and wiring the village for street lamps to Charles L. Zahm of Detroit, Mich., for $10,560.

ST. PARIS, OHIO.—A special election will soon be held to submit to the voters the proposal to sell the municipal electric-light and power plant to the Dayton Power & Light Company.

YOUNGSTOWN, OHIO.—The Cleveland & Mahoning Valley Traction Company is contemplating constructing a new interurban railway from Warren to Midland, the new industrial town being built by the Carnegie Steel Company. Right of way for the extension has been secured.

NEWPORT, KY.—The local electric plant of the Union Light, Heat & Power Company was recently damaged by fire, causing a loss of about $25,000.

PADUCAH, KY.—Improvements to the municipal electric-light plant are under consideration by the City Commission, which will include the installation of two 300-kw. generators and other apparatus, to cost about $52,000.

WHITESBURG, KY.—The Caudill Coal Company is preparing for extensive operations on its local coal properties, and will install electrically operated machinery. The cost of the proposed plant is estimated at $35,000. L. W. Fields is general manager.

GARRETT, IND.—The Baltimore & Ohio Railroad Company, it is reported, is contemplating the construction of a one-story power house, 71 ft. by 80 ft., in Garrett.

MUNCIE, IND.—The Muncie Electric Light Company is planning to install the new ornamental lighting system provided for in the new franchise recently granted the company.

CHICAGO, ILL.—The Union Electrical Engineering Company has submitted a proposal to the City Council offering to furnish electricity and gas to the city of Chicago at reduced rates. W. R. Furthman is secretary.

CHICAGO, ILL.—Plans have been prepared for Armour & Company for the erection of a two-story reinforced mechanical shop, 110 ft. by 304 ft., on West Thirty-ninth Street and Packers' Avenue, to cost about $70,000.

CHICAGO, ILL.—Land has been purchased by the Chicago Short Line Railway Company, which serves the Iroquois Iron Company, the Mark Manufacturing Company and other industries in the Calumet district of Chicago, upon which it proposes to erect a round-house and coal pocket.

LEWISTOWN, ILL. — The Lewistown Electric Company, it is reported, is making improvements to its plant.

OTTAWA, ILL.—Work will begin at once by the Northern Illinois Light & Traction Company on improvements to its local street railway and lighting system, involving an expenditure of about $80,000.

BELOIT, WIS.—The City Council has authorized the street lighting committee to complete plans for the improved lighting system. The committee was also instructed to consider the lighting requirements with a view of making changes in the system as applied to the outside districts in the city. The removing of overhead wires in the business section of the city is also under consideration.

BLOOMER, WIS.—The property of the Bloomer Electric Light & Power Company, including the local power plant and electric transmission line between Bloomer and Chippewa Falls, has been purchased by the Wisconsin-Minnesota Light & Power Company of Eau Claire.

STANLEY, WIS.—The Wisconsin-Minnesota Light & Power Company is erecting an electric transmission line between Chippewa Falls and Stanley.

GILBERT, MINN.—The Mesaba Railway Company of Virginia is contemplating replacing its wooden poles with steel poles in Gilbert. Peter Cosgrove is superintendent of the water and light commission.

MANKATO, MINN.—The Commonwealth Utilities Company of Mankato, Minn., has petitioned the Board of Railroad Commissioners of the State of Iowa for a franchise to erect transmission lines on certain roads and highways in Kossuth and Winnebago Counties, Iowa, to supply electricity for lamps and motors for a period of 25 years.

ROCHESTER, MINN.—Work has started on the construction of the dam in connection with the municipal hydroelectric plant 12 miles north of Rochester, on the Zumbro River, for the city of Rochester. The plan will cost about $650,000 and when completed will generate sufficient power to supply Rochester and several of the surrounding villages.

CEDAR RAPIDS, IOWA.—The Iowa Falls Electric Company of Cedar Rapids has been granted permission by the State Railroad Commission of Iowa to erect and operate electric transmission lines on certain roads and highways in Hamilton and Worth Counties for a period of 25 years.

DES MOINES, IOWA.—Property has been purchased by the Des Moines City Railway Company south of South Park on which it will erect a substation to furnish power for the South Side line. Equipment for the station has been purchased.

SIOUX CITY, IOWA.—In order to economize in coal and copper, and to provide for an increasing demand for electrical service, the Sioux City Service Company will make extensive improvements at once to its power plant and distributing system. Fred A. Krehbiel and Edward N. Lake of the Krehbiel Company of Chicago, Ill., have co-operated with the company's engineers in making detailed tests and reports.

WATERLOO, IOWA.—The Cedar Valley Electric Company of Waterloo has applied to the Board of Railroad Commissioners of the State of Iowa for permission to erect electric transmission lines on certain roads and highways in Franklin County for the distribution of electricity for lamps and motors for a period of 25 years.

ST. LOUIS, MO.—The Spring Wheel Company, 730 Trendley Avenue, St. Louis, is reported to be in the market for electric motors, boilers, pressers, etc.

ST. LOUIS, MO.—The Selden-Breck Construction Company of St. Louis, which has the general contract for construction of the University Club Building, to cost about $525,000, has awarded sub-contract for electric wiring to the William A. Corrao Electric Company of St. Louis.

AVOCA, NEB.—At an election held recently warrants to the amount of $5,000 were voted for establishing an electric-lighting system. The cost of the system is estimated at between $6,000 and $7,000.

GREELEY, NEB.—An election will soon be held to vote on the proposal of issuing $13,000 in bonds to establish a municipal lighting and heating plant.

INDIANOLA, NEB.—The date for awarding contracts for construction of the proposed electric plant has been postponed by the City Council. The cost of the plant is estimated at $12,000. Grant & Fulton, Bankers' Life Building, Lincoln, are engineers.

PENDER, NEB.—Plans are being considered for rebuilding the municipal electric-light plant, at a cost of about $12,000.

PETERSBURG, NEB.—The Nebraska Gas & Electric Company of Norfolk, Neb., has been granted a franchise to supply electricity in Petersburg.

CLEARWATER, KAN.—Plans are being prepared by W. B. Rollins & Company, Railway Exchange, Kansas City, engineers, for improvements to the municipal waterworks system, to cost about $8,000. The proposed work will include generator, oil engine and pump.

GRENOLA, KAN.—The City Council has engaged W. B. Rollins, Railway Exchange, Kansas City, Mo., to prepare plans and supervise the proposed improvements to the electric-lighting system, to cost about $15,000. An election will soon be called to vote on bond issue.

HAYS, KAN.—Plans have been completed and approved for improvements to the municipal electric-light plant and waterworks system, to cost about $50,000. Bids, it is understood, will soon be asked for the work. E. T. Archer & Company, New England Building, Kansas City, Mo., are engineers.

LA CROSSE, KAN.—Contracts have been awarded for improvements to the municipal electric-lighting plant and waterworks system. Contract for pumping equipment not yet awarded. W. B. Rollins & Com-

pany, Railway Exchange, Kansas City, Mo., are engineers.

LENORA, KAN.—An election will soon be called to vote on the proposal to issue $10,000 in bonds for the installation of a new electric-lighting system.

MANHATTAN, KAN.—The Manhattan City & Interurban Railway is contemplating the purchase of a new or second-hand 200-kw. or 300-kw. rotary converter.

Southern States

RALEIGH, N. C.—The Carolina Power & Light Company is erecting a high-tension electric transmission line from its hydro-electric plant at Waters, S. C., to Laurinburg, where it will connect with the Yadkin River power system.

SPENCER, N. C.—The new car repair shops of the Southern Railway, now being completed, will be equipped for electrical operation.

WARSAW, N. C.—The City Council has approved a bond issue of $15,000 for the installation of an electric-lighting system.

ATLANTA, GA.—Arrangements have been made for the use of electric service from the Georgia Railway & Power Company at the United States Penitentiary.

ATLANTA, GA.—The Pratt Engineering Company is reported to be in the market for one 100-kw., 220-volt, two-wire compound direct-current generator; one three-phase, 60-cycle, 550-volt, squirrel-cage, alternating-current motor-generator set; two 150-cu. ft. air compressors with 550-volt, alternating-current motors, directly connected; one cupola blower; also miscellaneous motor-driven pumps. Joel Hurt, Jr., of Atlanta is president.

BARTOW, GA.—The Southern Leasing Corporation has contracted with the Georgia Railway & Power Company of Atlanta for energy to operate motors in connection with log washers and pumps at its Barytes mines.

CARTERSVILLE, GA.—The Thompson-Weinman Company, which owns and operates extensive barytes mines in this section, is in the market for one 150-hp., 2300-volt, three-phase, 60-cycle, 1800 r.p.m. squirrel-cage induction motor for direct connection to a centrifugal pump. Electricity will be secured from the Georgia Railway & Power Company.

LINDALE, GA.—Plans are being considered for the erection of a new dye house at the Massachusetts Mills. About 150 hp. in motors will be used. Contract for energy has been signed with the Georgia Railway & Power Company.

NEW HOLLAND, GA.—Arrangements are being made for equipping the plants of the Pacelet Manufacturing Company and the Gainesville Cotton Mills for electrical operation. Contracts have been placed for 506 electric motors of approximately 6000 hp. with the General Electric Company. Contract for wiring has not been awarded. J. E. Sirrine of Greenville, S. C., is engineer. B. M. Stallworth is manager of the cotton mills.

FELLSMERE, FLA.—Bonds to the amount of $20,000 have been voted to purchase the local electric and ice plants to be owned and operated by the municipality.

KEY WEST, FLA.—Bids will be received at the Bureau of Yards and Docks, Navy Department, Washington, D. C., until July 23, for construction of two officers' quarters, including electric-lighting systems, etc., at the distant control naval radio station, Key West. Specifications (No. 2422) can be obtained on application to the above bureau or to the commandant of the naval station named.

LIVE OAK, FLA.—The Econpena Lumber Company, it is reported, contemplates installing an electric-light plant for lumber mill.

CHARLESTON, TENN.—Equipment for an 1800-hp. hydroelectric plant, it is reported, will be purchased by John N. Adams, engineer.

CHATTANOOGA, TENN.—The Southern Ferro-Alloys Company has begun work on remodeling the old plant of the Southern Steel Works, which is to be equipped to manufacture ferro-silicon. Later on it is proposed to manufacture ferro-chromium and ferro-molybdenum; also alloys used in the manufacture of high-grade steel. Orders have been placed for three electric furnaces. The company has contracted with the Tennessee Power Company of Chattanooga for energy from the Hale's Bar plant to operate its works. P. J. Kruesi is president of the steel works.

WILDER, TENN.—The Albert Amusement Company is contemplating the construction of an electric plant to supply electricity for lamps and motors in Wilder.

LAMBERT, MISS.—Contract, it is understood, has been awarded for the construction of the proposed municipal electric-light plant, for which bonds to the amount of $12,000 have been voted.

PINE BLUFF, ARK.—The installation of a new ornamental lighting system in the business district is under consideration by the City Council. It is proposed to replace the cluster-lighting system with single lamps. The Pine Bluff Company has the contract for street lighting.

SPRINGDALE, ARK.—The plant and holdings of the Springdale Light & Power Company have been purchased by the Middle West Gas & Electric Company. The new company proposes to erect an electric plant and supply electricity in Springdale, Fayetteville and to the Rogers plant at Fayette. The cost of the plant and transmission lines is estimated at about $75,000.

KENTWOOD, LA.—C. A. Kent, owner of the Kentwood creamery, is reported to be in the market for equipment for a cold-storage plant, ice-making machinery, etc.

BARTLESVILLE, OKLA.—Plans have been completed for construction of a Masonic Temple and office building for the Masonic Building Association, to cost about $275,000. Messrs. McGregor & Everman, superintendents of the association, will have charge of construction of buildings. Bids are now being asked on materials and subcontracts, including general contract, steam heating, electric wiring, electric passenger elevators, ornamental sidewalk lamps, etc. J. H. Felt & Company, 800 Grand Avenue Temple, Kansas City, Mo., are architects.

ROCKY, OKLA.—An election will soon be called to submit the proposal to issue $15,000 in bonds for the construction of a water-works system and $5,000 for an electric-light plant.

EL PASO, TEX.—The El Paso Electric Railway Company has petitioned the City Council for a franchise to build a branch line from Hague Street, out Campbell Street to Kern Place.

SAN ANTONIO, TEX.—The San Antonio Traction Company and the Gas & Electric Company are to be consolidated under the name of the San Antonio Electric Company. The capital stock is placed at $4,700,000. The company is planning to build an electric railway between San Antonio and Austin, a distance of 82 miles.

STOCKDALE, TEX.—A movement has been started to establish an electric-light plant in Stockdale.

Pacific and Mountain States

ANACORTES, WASH.—The local fish cannery of the Great Northern Packing Company has been purchased by the International Packers of Seattle. The new owners contemplate the construction of an electric plant to supply electricity for lighting and power purposes at the works. A. H. Seeley is superintendent.

BREMERTON, WASH.—Bids will be received at the Bureau of Yards and Docks, Navy Department, Washington, D. C., until July 23, for construction of caisson gate for shipbuilding dock, including electric wiring, motors and other electrical apparatus, at the Navy Yard, Puget Sound, Wash. Specification (No. 2459) may be obtained on application to the above bureau or to the commandant of the navy yard named.

HOQUIAM, WASH.—The City Commission is considering a proposal submitted by Mayor McKee to lease the local distributing system of the Gray's Harbor Railway & Light Company for a period of five years. Bids were recently called for street-lighting and only the gas company submited a bid.

NORTH YAKIMA, WASH.—The Pacific Power & Light Company has authorized the erection of two additional 6600-volt circuits from the North Yakima substation, one to Selah and the other to Oldtown. Orders have been placed for three 250-kva., 6600/2300-volt transformers.

PORT ANGELES, WASH.—A special election has been called for July 20 to authorize a bond issue of $30,000 to retire outstanding warrants and to provide for extensions and improvements. Bonds in this amount were voted last year, but owing to an alleged technical irregularity were not sold.

SEATTLE, WASH.—The Board of Public Works has extended the date for receiving bids for the construction of a municipal hydroelectric plant from July 20 to Aug. 3. The date was changed at the request of the Allis-Chalmers Company.

SEATTLE, WASH.—The Hebb power site on the White River, owned by the Mountain Development Company, of which P. H. Hebb is president, has been purchased by the Western Washington Power Company, a subsidiary of the Puget Sound Traction, Light & Power Company, for about $1,000,000.

TACOMA, WASH.—A portable power station, including complete equipment of dynamos, etc., will be installed immediately by the Tacoma Railway & Power Company to increase the power service on the American Lake street car line. The station will be mounted on a flat car.

BEND, ORE.—A complete new lighting system will be installed in the mills, yards and buildings of the Gardner-Wilkinson Lumber Company.

COQUILLE, ORE.—Plans have been approved by the Chicago office for the rebuilding of the transmission line of the Oregon Power Company between Coquille and Myrtle Point, a distance of about 9 miles. The company is also to erect a new line between Coquille and Marshfield this summer. The Oregon Power Company is operated by H. M. Byllesby & Company of Chicago, Ill.

HERMOSA BEACH, CAL.—A campaign has been started by the Chamber of Commerce for the installation of an ornamental street-lighting system.

LOS ANGELES, CAL.—The City Council has approved the decision of the Public Service Commission to extend the temporary operating agreement with the Edison Electric and the Pacific Light & Power Companies for two years from July 1, 1917.

LOS ANGELES, CAL.—Negotiations are under way for the sale of surplus power generated by the aqueduct plant. It is proposed to sell about 13,500 hp., of which 8000 hp. is to be purchased by the Southern California Power Company and the remainder by the city of Pasadena.

TORRANCE, CAL.—The Pacific Electric Railway Company, it is reported, will alter and enlarge the plans for the construction of its shops at Torrance to provide for a plant for building new cars.

BOVILL, IDAHO.—Bonds to the amount of $5,000 have been voted for the installation of a municipal electric-light plant in Bovill.

KELLOGG, IDAHO.—The Bunker Hill & Sullivan Mining & Concentrating Company, it is reported, will soon begin the construction of an electrolytic zinc plant at Kellogg. The proposed plant will have an initial capacity of 30 tons per day.

POCATELLO, IDAHO.—The Burns lighting proposition which has been under consideration for some time has been rejected by the City Council upon recommendation of the highway and light committee, which had investigated the matter and did not think it feasible. The Council has contracted with the Idaho Power Company for lighting the streets of the city for a period of ten years.

RICHFIELD, UTAH.—The State Department has issued a certificate of convenience and necessity to the Southern Utah Power Company, giving the company permission to install a 100-hp. engine on Panguitch Creek and an electric distributing system in Panguitch; an electric transmission line from Beaver Station to Marysvale; a transmission line from Sevier to Marysvale; a distributing system in Marysvale and a transmission line to the Deer Trail mine to carry 300 hp. The company also asks for permission to build a 2500-hp. plant below the works at Beaver. Extensions to Milford and Newhouse and into the Lincoln mining district are also planned.

PHOENIX, ARIZ.—The State Corporation Commission has granted the Pacific Gas & Electric Company permission to issue $555,000 in bonds, the proceeds of which are to be used for extensions of its street railway system, enlarging its electric power plant and other improvements.

YUMA, ARIZ.—The Arizona-Mexico Land Company is contemplating the installation of a 3000-hp. pumping plant near Yuma, to pump water from the Colorado River to irrigate a tract of about 17,000 acres.

BUTTE, MONT.—Surveys are being made by the Montana Power Company for the construction of an electric railway and electric transmission line from Twin Bridges to the Bielenberg-Higgins and Lake Shore mines, a distance of 14 miles. The proposed railway will be built under the supervision of the Montana Power Company, but will be owned by the proprietors of the mines. The high-tension line will carry about 49,000 volts, to be stepped down to 2000 volts at the Higgins mines and from there transmitted to the Lake Shore mines. The cost of the railway is estimated at about $26,000.

TONOPAH, NEV.—Work has begun on the large auxiliary power plant in Nye County which will supply electricity for the Great Western and the Tonopah Bonanza mines.

Canada

OLDS, ALTA.—The by-law providing for the installation of an electric-lighting system has been approved by the ratepayers.

EHOLT, B. C.—The S. K. Power Company is contemplating the construction of a large substation at the Emma mine near Eholt.

FERNIE, B. C.—The Coal Creek Mining Company is reported to be considering the construction of an electric-lighting system in the Coal Creek mine.

KASLO, B. C.—The City Council is considering a proposal to heat the city hall and municipal building with electricity this coming winter.

NEW WESTMINSTER, B. C.—Plans have been completed by the Dominion Products Company for the erection of an addition, 115 ft. by 150 ft., to its local plant. New equipment, including fans and motors, four mechanical stokers and appurtenances and three high-pressure boilers, 18 ft. by 72 in., will be installed.

DRAYTON, ONT.—The ratepayers have approved a by-law appropriating $9,500 for the installation of hydroelectric power.

1,231,549. POST-TYPE ARC LAMP; Christian Aalborg and Samuel C. Hoey, Wilkinsburg, Pa. App. filed April 3, 1914. Inclosed.

1,231,557. MOTOR-CONTROL SYSTEM; Howard L. Beach, Edgewood Park, Pa. App. filed Oct. 23, 1913. Employed in connection with elevators, planers and similar machines.

1,231,568. ELECTRIC CABLE; Le Roy Clark, Englewood, N. J. App. filed March 10, 1915. Thin metallic flexible sheath which incases the conductor, providing a smooth exterior surface to which the coating of insulation is applied.

1,231,584. ELECTRICAL APPARATUS; Ralph E. Ferris, Swissvale, Pa. App. filed Dec. 31, 1913. Means for obviating the use of a shunt coil to prevent excessive speed in dynamotors or other compound-wound dynamo-electric machines.

1,231,587. SHIELDING SYSTEM FOR VAPOR CONVERTERS; Charles Le G. Fortescue, Pittsburgh, Pa. App. filed Aug. 9, 1915. Minimizes short-circuiting and reverse arcing.

1,231,588. MAGNETIC MATERIAL; Louis T. Frederick and Leon McCulloch, Wilkinsburg, Pa. App. filed Jan. 7, 1914. Material to be formed into wedges for use in the slots of dynamo-electric machines.

1,231,599. MOTOR-CONTROL SYSTEM; Edward A. Hanff, Wilkinsburg, Pa. App. filed Aug. 7, 1914. Means for insuring the establishment of initial starting conditions in motor circuits before they can be closed, after having been opened because of abnormal circuit conditions.

1,231,613. SYSTEM OF PUMP CONTROL; Henry D. James, Wilkinsburg, Pa. App. filed May 11, 1914. Improvement.

1,231,614. MOTOR-CONTROL SYSTEM; William R. Johnston, Wilkinsburg, Pa. App. filed Sept. 4, 1913. Adapted to be employed in connection with oil-well-drilling rigs and similar machines.

1,231,620. VENTILATING APPARATUS; Jan. A. Kuyser, Edgewood, Pa. App. filed March 3, 1914. Adapted for use in connection with dynamo-electric machines such as large turbo-generators and the like.

1,231,628. POTENTIAL REGULATOR; Edwin Lehr, Pittsburgh, Pa. App. filed May 3, 1915. Improvement.

1,231,648. TRANSFORMER; Emerson G. Reed, Wilkinsburg, Pa. App. filed Nov. 28, 1913. Simple and effective means for holding together the plates or laminas of which the core structure is composed.

1,231,652. SYNCHRONOUS DYNAMO-ELECTRIC MACHINE AND METHOD OF STARTING THEREFOR; Emanuel Rosenberg, Ashbourne, Dowdon, England. App. filed April 25, 1914. Improvement.

1,231,658. CONTROL SYSTEM; Karl A. Simmon and Arthur J. Hall, Wilkinsburg, Pa. App. filed April 6, 1914. Special reference to alternating-current control systems embodying induction motors.

1,231,659. ELECTRICAL PROTECTIVE DEVICE; Benjamin H. Smith, Turtle Creek, Pa. App. filed May 4, 1916. Improvement.

1,231,666. REGULATING CONTROLLER FOR ELECTRIC MOTORS; Harve R. Stuart, Springfield, Ohio. App. filed July 17, 1912. Improvement.

1,231,667. INCANDESCENT LAMP; Howard A. Styring, Middletown, Ohio. App. filed Jan. 21, 1916. Head of the lamp upon which the bulb is carried is provided with a plurality of conducting portions which are so formed as to allow only a limited number thereof to engage the contacts carried by the electric socket.

1,231,708. BATTERY TESTER; Emerson L. Clark, Lakewood, Ohio. App. filed March 9, 1915. Improvement.

1,231,714. STARTING DEVICE FOR MULTIPHASE MOTORS; Henry H. Cutler, Milwaukee, Wis. App. filed Nov. 2, 1916. Provides means for removing resistance from the motor circuit in such a manner that the motor will gradually increase in speed without undue strain upon the motor or power circuit.

1,231,749. ELECTRICALLY HEATED INSTRUMENT; Frank Kuhn, Detroit, Mich. App. filed Aug. 30, 1915. Increase in efficiency in the distribution of the heat from the resistor to the work surface.

Record of Electrical Patents

Notes on United States Patents issued on July 3, 1917

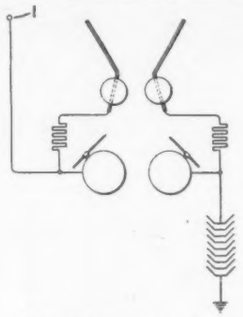
1,231,750. LUMINOUS ELECTRIC HEATER; Frank Kuhn and Frank E. Shailor, Detroit, Mich. App. filed Sept. 9, 1915. Heat is distributed from a plurality of luminous points.

1,231,758. UNIVERSAL LAMP BASE; Louis O. Lieber, Los Angeles, Cal. App. filed Dec. 27, 1915. May be put together or released by a comparatively small movement.

1,231,760. UNIVERSAL RECEPTACLE; Louis O. Lieber, Los Angeles, Cal. App. filed Feb. 23, 1916. Improvements.

1,231,762. SWITCH FOR ELECTRIC SIGNS; John E. Long, Hot Springs, Mont. App. filed Aug. 18, 1916. Provides pneumatically controlled switches which will enable the user to operate the sign without requiring an attendant to insure the smooth running of the apparatus.

1,231,804. WIRE CLAMP; Harry C. Staton, Burlington, Iowa. App. filed Nov. 27, 1916. Means whereby a contact may be formed between two insulated wires without having to remove the insulation.



1,232,467—Spark Gap

1,231,819. ELECTRIC LAMP SOCKET; David A. Walling, Merryville, La. App. filed Jan. 29, 1917. Provides diametrically oppositely disposed electrical conductors carried by the porcelain core and provided with a contact ring spirally arranged.

1,231,821. VARIABLE ELECTRIC SIGN; Herman F. Walton, South Bend, Ind. App. filed Dec. 31, 1914. Means for producing any desired form of display writing on the electric signboard.

1,231,829. PROCESS FOR ELECTROLYTICALLY PRECIPITATING METALS; George C. Westby, Ludwig, Nev. App. filed March 21, 1916. Improvements.

1,231,844. BRUSH-LIFTING DEVICE; Arthur J. Brown, Milwaukee, Wis. App. filed Aug. 3, 1914. Current-conducting element between the brushes and the brush holder or cross-connecting ring is utilized as a portion of the brush-lifting mechanism.

1,231,848. ELECTRIC-LIGHT SUPPORT; Giuseppe A. Centolella, Clinton, N. Y. App. filed May 23, 1916. Upon the arm of a sewing machine.

1,231,875. MAGNETIC CHOKING DEVICE; Hiram H. Gifford and William Gifford, Traverse City, Mich. App. filed June 10, 1916. Gives the lightning arrester sufficient opportunity to act before the high-frequency current can pass the choking device.

1,231,882. CLUSTER TOP FOR ELECTRIC LAMPS; Edmund J. Y. Hammett, Philadelphia, Pa. App. filed Nov. 7, 1916. "Period" reproduction, floor and table electric lamps.

1,231,883. APPARATUS FOR ELECTRICAL STERILIZATION OF FOOD; Jacob Hanssen, Christiania, Norway. App. filed Oct. 7, 1916. Improvements.

1,231,895. APPARATUS FOR REGULATING THE TEMPERATURE OF SUPERHEATED STEAM; David S. Jacobus, Jersey City, N. J. App. filed June 11, 1915. Improvements.

1,231,953. ELECTRIC POWER SYSTEM; Harry M. Shedd, Elizabeth, N. J. App. filed March 11, 1916. Improvement.

1,231,955. ELECTROLYTIC CELL STRUCTURE; Henry B. Slater, Riverside, Cal. App. filed March 21, 1914. Provides a combined anode and diaphragm for an electrolytic cell, the diaphragm being readily removable for cleansing and replacement.

1,231,992. ELECTRICAL SWITCH; Oscar R. Blumberg and Bryson D. Horton, Detroit, Mich. App. filed June 2, 1914. Designed primarily for service as a three-phase motor starter.

1,232,012. INDUCTION MOTOR; Adolphus M. Dudley, Pittsburgh, Pa. App. filed Oct. 3, 1913. Squirrel-cage type.

1,232,055. MECHANISM FOR CONVERTING MOTION; James B. Lee, Savannah, Ga. App. filed Nov. 20, 1916. Means for converting reciprocatory motion into a rocking or oscillating motion.

1,232,106. SET AND RELEASE DEVICE FOR CIRCUIT BREAKERS AND OTHER MECHANISM; Oscar F. Shepard, Jr., Cincinnati, Ohio. App. filed Dec. 18, 1911. Improvement.

1,232,209. SYNCHRONOUS MOTOR; Arthur R. Bullock, Cleveland, Ohio. App. filed Oct. 19, 1912. To eliminate the hunting action.

1,232,253. ELECTRICAL APPARATUS; Alvarado L. R. Ellis, Lynn, Mass. App. filed July 8, 1915. For electrical instruments having two or more coils or windings adapted to be connected in series or parallel, or series-parallel, for varying the effect or range of the apparatus or instrument.

1,232,278. INSULATOR; Walter T. Goodard, Hamilton, Ontario, Canada. App. filed April 4, 1916. Strain.

1,232,372. CONTROLLING APPARATUS FOR ELECTRICAL MOTORS; Harley C. Mosley, Portsmouth, Ohio. App. filed Dec. 30, 1915. Improvements.

1,232,354. INSULATOR; John E. Mair, Pittsburgh, Pa. App. filed Nov. 28, 1916. Knob.

1,232,362. ELECTRIC FURNACE; Claude G. Miner, Berkeley, Cal. App. filed Feb. 17, 1917. For laboratory and scientific work on a small scale.

1,232,412. SWITCH AND FUSE CONSTRUCTION; Hermon L. Van Valkenburg, Edgewater Park, N. J. App. filed April 21, 1913. For use in connection with electric distributing systems such as are employed in the interior wiring of buildings.

1,232,450. RESISTANCE ELEMENT; Joseph A. Misland, Bayonne, N. J. App. filed Sept. 9, 1916. Resistance wire is preferably in the form of a spiral coil suitably supported by an inner insulating support throughout its entire length when contracted and throughout most of its length when extended.

1,232,451. ELECTRIC REGULATING DEVICE; Joseph A. Misland, Bayonne, N. J. App. filed Sept. 9, 1916. Provides improved means of support for the extensible coil and, if desired, an improved form of cross-section of wire for the purpose.

1,232,453. ANNUNCIATOR; Albert Sullwold, Grove, Okla. App. filed Oct. 4, 1915. Operation is under thermostatic control.

1,232,456. RELAY; William L. Bliss, Brooklyn, N. Y. App. filed Dec. 26, 1908. Provides a fluid-pressure responsive device for actuating certain instrumentalities and electromagnetically operated means for regulating the pressure upon said fluid-pressure responsive device.

1,232,467. SPARK GAP; Frank W. Peek, Jr., Schenectady, N. Y. App. filed Aug. 19, 1915. Relates to lightning arresters of the type having a spark gap for relieving transmission lines and other conductors of transient voltages and similar abnormal conditions.